NASA SP-7500

MANAGEMENT

A CONTINUING LITERATURE SURVEY

– With Indexes –

A selection of annotated references to unclassified reports and journal articles entering the NASA Information System from 1962 through 1967

Scientific and Technical Information Division
OFFICE OF TECHNOLOGY UTILIZATION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MARCH 1968
Washington, D.C.

Introduction

Management is a compilation of references to unclassified reports and periodical articles on the subject of management that may be found in the NASA scientific and technical information system. The publication assembles groups of citations formerly announced in separate journals, *Scientific and Technical Aerospace Reports (STAR)* and *International Aerospace Abstracts (IAA)*, to provide management with a convenient information tool.

The present issue covers material generated or sponsored by NASA during the period 1962 through 1967. The selection of items for reannouncement was made on the basis of general interest, usefulness, and applicability, but is by no means exhaustive. Future issues will announce additional items as these come to light or as specific interest in a particular area or areas may dictate.

For greater convenience the selected items are grouped in nine categories. These are shown in the table of contents with appropriate scope notes. The categories bear no relationship to those in *STAR* and *IAA* but have been specially chosen for this publication. Three indexes are provided—subject, personal author, and corporate source.

Items concerning management in the fields of reliability and quality assurance have for the most part been excluded. Such items appear in *Reliability Abstracts and Technical Reviews (RATR)*, a monthly journal prepared for NASA by the Research Triangle Institute, Durham, North Carolina.

Many of the abstracts included in *Management* have been reproduced from those appearing in *STAR* and *IAA*. This procedure, adopted in the interests of economy, has introduced some variation in size, style, and intensity of type.

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For further details please consult the *Introductions* to *STAR* and *IAA*, respectively.

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Other organizations can purchase copies of the bibliography from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

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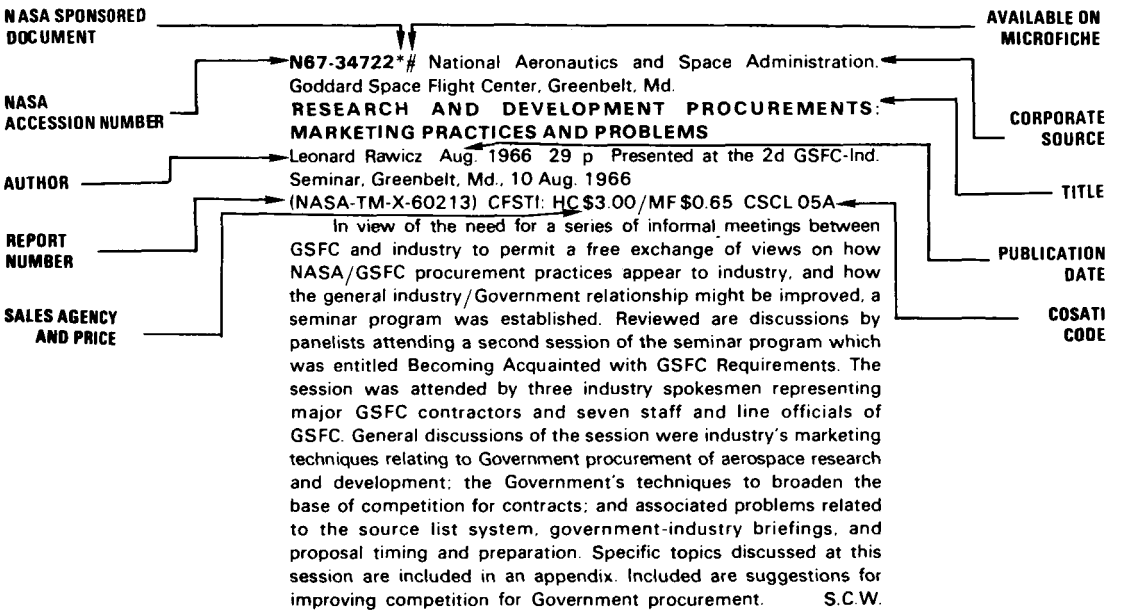

N67-34722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RESEARCH AND DEVELOPMENT PROCUREMENTS: MARKETING PRACTICES AND PROBLEMS

Leonard Rawicz Aug. 1966 29 p Presented at the 2d GSFC-Ind. Seminar, Greenbelt, Md., 10 Aug. 1966

(NASA-TM-X-60213) CFSTI: HC $3.00/MF $0.65 CSCL 05A

In view of the need for a series of informal meetings between GSFC and industry to permit a free exchange of views on how NASA/GSFC procurement practices appear to industry, and how the general industry/Government relationship might be improved, a seminar program was established. Reviewed are discussions by panelists attending a second session of the seminar program which was entitled Becoming Acquainted with GSFC Requirements. The session was attended by three industry spokesmen representing major GSFC contractors and seven staff and line officials of GSFC. General discussions of the session were industry's marketing techniques relating to Government procurement of aerospace research and development; the Government's techniques to broaden the base of competition for contracts; and associated problems related to the source list system, government-industry briefings, and proposal timing and preparation. Specific topics discussed at this session are included in an appendix. Included are suggestions for improving competition for Government procurement. S.C.W.

NASA

MANAGEMENT

a continuing literature survey

MARCH 1968

STAR ENTRIES

M1 PROGRAM MANAGEMENT

N67-39766* Boeing Co., Seattle, Wash. Aerospace Group.
VOYAGER SPACECRAFT SYSTEM TASK C CONFIGURATION DATA AND MANAGEMENT STUDY Final Technical Report, Apr. 1966–Jul. 1967
Jul. 1967 455 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951111)
(NASA-CR-89735; D2-113582-1) CSCL 22B

Various methods of providing indices of configuration identification data using automated data processing techniques are reviewed, and a system is recommended for use on the Voyager program. Included is a review of methods for providing actual data copies such as drawings, specifications, reports, and procedures. A recommendation is made for an aperture card system for reproducing drawings and a microfiche system for reproducing book form documentation, and a critique of configuration management procedures is included. Author

N67-34460*# Columbia Univ., New York. Operations Research Group.
OPTIMAL CONTINUOUS REVIEW POLICIES FOR TWO PRODUCT INVENTORY SYSTEMS WITH JOINT SETUP COSTS
Edward Ignall 15 Dec. 1966 13 p refs
(Contract Nonr-266(55))
(NASA-CR-87490; TR-35; AD-650793) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Minimum average cost ordering policies for continuously reviewed two product inventory systems with joint setup costs are sought. Disappointingly, the optimal policy, even in a simple symmetric case, is not always simple: For some values of cost and demand parameters, a policy that would be difficult to implement is optimal. Markov Renewal Programming is used to find the region in parameter space where a given policy is optimal. TAB

N67-30814*# California Univ., Berkeley. Space Sciences Lab.
SYSTEMS APPROACH: PART III
C. West Churchman May 1967 61 p *Its* Internal Working Paper No. 64
(Grant NsG-242-62)
(NASA-CR-85563) CSCL 05A

Management science and operations research are evaluated with respect to their utility in total effectiveness when dealing with industrial firms or government agencies. The systems approach is discussed in terms of objectives, and it is assumed that the scientist and planner are responsible for determining the real objectives of the customer. The behavioral scientist's role in the system approach is analyzed. Finally the so-called "anti-planning" approach to systems is defined and conclusions are drawn. S.P.

N67-21962*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIRST ANNUAL LOGISTICS MANAGEMENT SYMPOSIUM, SEPTEMBER 13 AND 14, 1966
16 Jan. 1967 126 p
(NASA-TM-X-53566) CFSTI: HC $3.00/MF $0.65 CSCL 05A

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8. THE GROWING NEED FOR LOGISTICS ENGINEERS W. von Braun (NASA. Marshall Space Flight Center) p 42–45 (See N67-21970 11-11)
9. MANAGEMENT OF LOGISTICS SUPPORT S. B. Smeltzer (N. Am. Aviation, Inc.) p 49–55 (See N67-21971 11-11)
10. THE PROGRAM MANAGERS' PROBLEM A. Rudolph p 56–60 (See N67-21972 11-11)
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13. CONTRACTING FOR LOGISTICS SUPPORT: (INDUSTRY POSITION) S. C., Hellman (Boeing Co.) p 68–70 (See N67-21975 11-11)

14. MEASURING LOGISTICS PERFORMANCE J. F. Sutherland (McDonnell Aircraft Corp.) p 71–72 (See N67-21976 11-11)

15. EVALUATION IMPLEMENTATION H. J. P. Foley, Jr. (Aviation Supply Office) p 73–74 (See N67-21977 11-11)

16. VISIBILITY FOR EVALUATION J. G. Zierdt (Army Missile Command) p 75–77 (See N67-21978 11-11)

17. SUPPORT VERSUS TOTAL PROGRAM EVALUATION F. E. Waller (NASA. Manned Spacecraft Center) p 78–79 (See N67-21979 11-11)

18. PROCUREMENT EVALUATION J. L. McCoy (Ballistic Sys. Div.) p 80–81 (See N67-21980 11-11)

N67-14934*# National Aeronautics and Space Administration, Washington, D.C.

THIS NEW OCEAN. A HISTORY OF PROJECT MERCURY

Loyd S. Swenson, Jr., James M. Grimwood, and Charles C. Alexander 1966 694 p refs

(NASA-SP-4201) GPO: HC $5.50; CFSTI: MF $7.15 CSCL 22B

A detailed account is given of the managerial and technological history of Project Mercury. Preliminary progress in rocketry and research in space medicine, aerodynamics, and thermodynamics from the end of the Second World War to the inception of the first U.S. manned satellite project is recounted emphasizing the contributions of individual minds and small groups of experimentalists. The technological and managerial aspects of Project Mercury are related, including organizing, contracting, innovating, manufacturing, training, and testing, giving insight into the enormity and intricacy of modern government-managed technological programs. The fulfillment of Project Mercury is described, beginning with the suborbital flight of astronaut Alan B. Shepard, Jr., proceeding through the completion of the orbital qualification of the Mercury spacecraft and the Atlas rocket, and ending with the four manned orbital missions. Details are given on the functional organization of Project Mercury, workflow organization, flight data, cost summaries, and tracking net, and an extensive bibliography is included. L.E.W.

N67-12167*# Bellcomm, Inc., Washington, D. C.

PROCEDURES FOR MANAGEMENT CONTROL OF COMPUTER PROGRAMMING IN APOLLO

B. H. Liebowitz, C. S. Sherrerd, and E. B. Parker, III 28 Sep. 1966 206 p refs

(Contract NASw-417)

(NASA-CR-80132; TR-66-320-2) CFSTI: HC $6.00/MF $1.25 CSCL 09B

Formal techniques for management control are required to ensure the production and delivery of working, usable computer programs. A set of techniques, which are general enough to be applied across the variety of computer programming tasks found in the Apollo Project, are set forth in this report. Because most of the large, mission-critical computer programs in Apollo are developed by outside contractors, various aspects of the user-contractor relationship are given particular attention. Author

N66-37813*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.

THE TASK MANAGER

William D. Carpenter Oct. 1965 14 p refs

(NASA-TM-X-53341; X-542-65-445) CFSTI: HC $1.00/MF $0.50 CSCL 09B

Principles and objectives of management are discussed in an informal manner. The requirements for successfully planning a job are presented from the viewpoint of the data systems task manager. A breakdown of major milestones such as abstracting, system analysis and design, system description, flow charting, coding, checkout, simulation, and documentation is given, and instruments for scheduling and reporting are recommended. A.G.O.

N66-31233*# National Aeronautics and Space Administration, Washington, D. C.

STRUCTURAL SYSTEMS AND PROGRAM DECISIONS, VOLUME I

[1966] 437 p refs

(NASA-SP-6008) CFSTI: HC $4.00/MF $2.25 CSCL 20K

A computer weight/performance forecasting procedure which is able to assess design and program changes and to optimize structural systems similar to those of the Saturn V launch vehicle was developed. The procedure is intended to provide management with the information necessary to examine design criteria and philosophy, geometrical constraints, and environmental considerations for their effects on the structural system of a given space vehicle. It is capable of handling the materials normally used in aerospace launch vehicle construction, and the following structural configurations: monocoque, semi-monocoque, 90° waffle, 45° waffle, integral stringer and ring, and honeycomb sandwich construction. In addition, the system will: (1) compare various structural configurations to determine the minimum weight construction for the specific application; (2) compare weights of optimum design structures made from various materials which are acceptable for a specific application; (3) determine the approximate weights of the above; and (4) assess the change in structural weight due to changes in loads and/or design criteria. D.T.

N66-30756*# George Washington Univ., Washington, D. C.

MAJOR FACTORS IN AEROSPACE PLANNING AND DECISION

Robert G. Smith 10 May 1966 184 p refs

(Grant NsG-727)

(NASA-CR-76298) CFSTI: HC $5.00/MF $1.25 CSCL 05A

An analysis of economic, technical, and socio-political factors considered by aerospace industry managers in their long range planning and decision making functions was conducted, to focus attention on the interdisciplinary aspects of the space-age planning process. Personal contact was made with managers of various government agencies and aerospace companies to determine management's role in decision making, and it was concluded that there was no universally acceptable planning format for all companies in all situations. It is intended that this analysis offer general insight into the challenges and problems facing aerospace industry managers. The impact on the aerospace industry of such variables as the war in Vietnam, Soviet technological advances, and the cold war are evaluated; and the conclusions and recommendations generated from this study are listed. H.S.W.

N66-29966*# National Aeronautics and Space Administration, Washington, D. C.

FORECASTS AND APPRAISALS FOR MANAGEMENT EVALUATION, VOLUME I

[1965] 229 p refs

(NASA-SP-6009, Vol. I) CFSTI: HC $3.75/MF $1.25 CSCL 09B

Forecasts and Appraisals for Management Evaluation (FAME), an operations research system concerned with applying scientific methods to problems facing management, is described. Forecasting concepts and utilization of a general data-handling system with particular application to weight/performance control are presented to assist managers and contractors on the Apollo Program. Techniques are applied to the weight/performance control of spacecraft, launch vehicles, and respective functional systems. Exhibits of work sheets, printouts, and reporting forms to management accompany the discussion. The design requirements, executive routine, and operation of the FAME computational system

are examined. Types of information and methods of transmitting data to management are illustrated by charts and graphs. Application of FAME to areas such as cost, schedule, vehicle performance, and electrical power surveillance is pointed out. S.P.

N66-20937*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTEGRATING SPACECRAFT SYSTEMS
Allen L. Franta Washington, NASA, Apr. 1966 23 p refs (NASA-TN-D-3049) CFSTI: HC $0.30/MF $0.50 CSCL 22B

The integration of a satellite or spacecraft system consists of combining the mechanical and electrical subsystem elements into a single entity through the application of logical processes, and takes into account the physical and functional aspects of the subsystem interrelationships. It is characterized by three levels of effort: (a) project management integration, (b) integration of physical systems, and (c) integration by subsystem combination through advanced design. The overall coordination of a spacecraft project is a responsibility of a project management group assigned the task of translating functional concepts into an operating spacecraft. The actual physical integration of a spacecraft system is accomplished through the combined work of a mechanical integration group and an electronic integration group working together in a concerted effort. Subsystem combination through advanced electronic design is a more sophisticated form of partial spacecraft integration. Author

N66-13842*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEMS ENGINEERING IN SPACE EXPLORATION
1 Jun. 1965 55 p Proc. of the Space Technol. Seminar, Stanford Univ., Calif., 1 May–5 Jun. 1963
(Contract NAS7-100)
(NASA-CR-68801) CFSTI: HC $3.00/MF $0.50 CSCL 22A

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1. SYSTEMS ENGINEERING IN SPACE EXPLORATION J. Small p 1–14 (See N66-13843 04-30)
2. SYSTEMS DESIGN W. Downhower p 15–31 (See N66-13844 04-30)
3. SYSTEMS ANALYSIS C. R. Gates p 33–37 (See N66-13845 04-30)
4. SPACE FLIGHT OPERATIONS M. Johnson p 39–43 (See N66-13846 04-30)
5. PROGRAM ENGINEERING AND PROJECT PROBLEMS J. Small p 45–53 (See N66-13847 04-30)

N65-81945* California Univ., Berkeley. Space Sciences Lab.
DECISION MAKING AND RESOURCE ALLOCATION IN A PUBLIC HEALTH AGENCY Internal Working Paper No. 18
David Hudson Stimson Dec. 1964 387 p refs
(Grant NsG-243-62)
(NASA-CR-60632)

Reported is a study designed to analyze through the method of operations research the decision making process of the California State Department of Public Health in its administration and allocation of a federal grant-in-aid to the State for improving outside-the-hospital services for chronically ill and aged persons. Research was shaped by three hypotheses set forth as the following questions: (1) Can a resource allocation problem in a public health agency be formulated in decision theoretic terms and can a model yielding a normative solution be derived? (2) Can the goals of a decision maker be identified and incorporated into such a model? (3) Can organization theory yield the insights needed to explain the behavior of members of the Department and to identify the elements (the decision maker, the environment, the alternatives, and the objectives) of the allocation problem? Research was limited to a study of the allocation of the CI&A grant by the Department into the following three major categories: services, demonstrations, and administrative overhead. The model gave an overall framework for the allocation decision, made it possible to delineate further studies that should be made, and selected the best alternative for allocating the CI&A grant among the three major categories cited. Objectives for the CI&A program were identified and used in the model, and the use of organization theory yielded insights into the behavior observed in the Department. Limitations of the study and the model, and benefits of the study to the Department, are discussed. S.C.W.

N65-30564*# National Aeronautics and Space Administration, Washington, D. C.
TIROS: THE SYSTEM AND ITS EVOLUTION
[1965] 31 p
(NASA-TM-X-56696) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Problems and factors which affected the development of the TIROS Project are reviewed. The evolution and history, design, and operational information concerning the TIROS system are discussed. R.N.A.

N65-15188*# Washington U., St. Louis, Mo.
PRODUCT MANAGEMENT FOR DEFENSE/SPACE MARKETS
Murray L. Weidenbaum [1964] 10 p refs Presented to Am. Marketing Assn., Chicago, 29 Dec. 1964
(Grant NsG-342)
(NASA-CR-60227) OTS: HC $1.00/MF $0.50

The defense–space market is an area of industry where, although an identifiable activity labeled product management generally does not exist, the function of product management may be of unparalleled importance. This paper describes the unique characteristics of the military–space market and the unusual distribution of effort within the overall marketing function. Because of the extremely rapid rates of product innovation and product obsolescence, the management decisions critical to the existence and growth of the military-oriented company relate to the composition of its future product line. Author

N65-11378*# National Aeronautics and Space Administration, Washington, D. C.
MANAGEMENT REQUIREMENTS FOR SPACE EXPLORATION
Robert C. Seamans, Jr. [1964] 9 p Presented to the Apollo Luncheon, Natl. Aeron. and Space Eng. Meeting, Sae, Los Angeles, 8 Oct. 1964

The problem of uneconomic use of human and financial resources in the space program caused by schedule slippages in R&D contracts is discussed at length. It is stated that R&D must be controlled. Some of the approaches to this desirable control are mentioned, such as the use of incentive contracts wherever possible, improved quality control, extensive environmental testing, better task specifications, and the use of sound reporting methods, such as PERT. Several specific aspects of the problem of controlling R&D programs are discussed, and Mr. Seamans' personal views of the future trends in space program contracting are given. D.E.W.

M2 CONTRACT MANAGEMENT

N67-40192* Washington Univ., St. Louis, Mo. Economics Dept.
COMPETITION IN HIGH TECHNOLOGY GOVERNMENT MARKETS

Murray L. Weidenbaum Nov. 1967 29 p refs *Its* Working Paper No. 6713
(Grant NsG-342)
(NASA-CR-89597) CSCL 05C

The nature of competition in high technology government markets, notably the Department of Defense and the National Aeronautics and Space Administration, is examined. In the absence of comprehensive information on individual competitions for government contacts, turnover data and concentration ratios are developed as a guide to the extent to which relatively few firms dominate this market area. Analyses of the size distribution of leading government contractors also help to illuminate the nature of the competitors for government contracts. On balance, statements so frequently made concerning the large degree of concentration and monopoly in government procurement are not supported by the data. Author

N67-34722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESEARCH AND DEVELOPMENT PROCUREMENTS: MARKETING PRACTICES AND PROBLEMS
Leonard Rawicz Aug. 1966 29 p Presented at the 2d GSFC-Ind. Seminar, Greenbelt, Md., 10 Aug. 1966
(NASA-TM-X-60213) CFSTI: HC $3.00/MF $0.65 CSCL 05A

In view of the need for a series of informal meetings between GSFC and industry to permit a free exchange of views on how NASA/GSFC procurement practices appear to industry, and how the general industry/Government relationship might be improved, a seminar program was established. Reviewed are discussions by panelists attending a second session of the seminar program which was entitled Becoming Acquainted with GSFC Requirements. The session was attended by three industry spokesmen representing major GSFC contractors and seven staff and line officials of GSFC. General discussions of the session were industry's marketing techniques relating to Government procurement of aerospace research and development; the Government's techniques to broaden the base of competition for contracts; and associated problems related to the source list system, government-industry briefings, and proposal timing and preparation. Specific topics discussed at this session are included in an appendix. Included are suggestions for improving competition for Government procurement. S.C.W.

N67-34156*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
THE ROLE OF FOLLOW-ON CONTRACTS IN GOVERNMENT-SPONSORED RESEARCH AND DEVELOPMENT
Edward B. Roberts and William H. Dyer, III Jul. 1967 31 p refs
(Grant NsG-235)
(NASA-CR-87404; Rept.-269-67) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Eighteen new business research and development (R&D) contracts were studied to determine the effects of considerations of follow-on potential on contract performance and to determine the impact of these factors on further contract acquisition. The three dimensions of contract performance (schedule, cost, and technical) correlated significantly with each other, and problems in each area correlated with the growth in contract costs. These contract problems were greatest in those cases where greatest potential R&D and production follow-on was expected at the time of original proposal preparation. This suggests that companies that anticipated large follow-ons wrote into their initial R&D proposals promises of unrealistic time schedules, cost estimates and technical performance goals. The general likelihood of R&D follow-ons was more accurately predictable at the time of original proposal preparation than is the likelihood of production follow-ons. However, except for the trivial cases in which it was clear that no follow-on potential exists, defense/space marketing men appeared unable to predict effectively the dollar magnitude of the resulting follow-on contracts. The greater the problems encountered during contract life, the less the original expectation of direct follow-on from the same government agency was realized. However, this was counterbalanced by a marked improvement in win ratio in technically related competitions conducted by other government agencies. Author

N67-31553*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
THE MEASUREMENT AND IMPROVEMENT OF R&D MARKETING EFFECTIVENESS
Edward B. Roberts Jan. 1967 18 p ref Presented at the 5th Ann. Management Conf. on Marketing in the Defense Ind., Boston, 19 May 1966; sponsored by Defense Marketing Group, Am. Marketing Assoc., and Bur. of Business Res.
(Grant NsG-235)
(NASA-CR-85971; Rept.-235-66) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Reviewed are initially the results of studies made of two Department of Defense field centers in which a total of 90 R&D contract awards above $100,000 in size were examined. The differences between winners and losers on the same sets of R&D competition are pointed out. To measure R&D marketing effectiveness, a series of comparative analyses were made of the strategies of nine companies located along the eastern seaboard ranging in size from several millions of dollars in sales to several hundred million dollars. A total of 121 competitions were studied. Analyzed were the numeric contract capture ratio, the dollar capture ratio, and the return on proposal investment. A major finding of the study is that the winners in competitive bidding are usually those companies that have done sufficient work with the government technical initiator of R&D procurement to be listed first or second on his suggested source list. Measures to improve the R&D marketing effectiveness include improved marketing analyses, more integrated funding and decision making, logic and rationality in binding, concentration on the early phases of the competition, and orientation of a company's engineering staff toward marketing. K.W.

N66-35961*# George Washington Univ., Washington, D. C.
AN INVESTIGATION OF PROFIT RATES IN DEFENSE CONTRACTING
Charles E. Bradley, Kate A. Arbogast, Patrick Ross Huntley, and Clayton C. Mc Cuistion [1966] 132 p refs
(Grant NsG-425)
(NASA-CR-77868) CFSTI: HC $3.00/MF $1.00 CSCL 05C

An examination is presented of the cost of capital in selected industry groups, with emphasis placed on firms primarily involved with government contracting. Time series data and the customary ratio analysis for specific industry groups are given. An evaluation is shown of the overall profit outcomes in terms of a general measure of the cost of capital for the groups developed. Adaptations are made of models which capital theorists offer as descriptive of market behavior and normative for managerial decisions. A test is presented of the reasonableness of profits for renegotiation board objectives, and a summary description of the various profit theories of economics is included. C.T.C.

N66-24117*# George Washington Univ., Washington, D. C.
CONTRACTOR DECISION MAKING AND INCENTIVE FEE CONTRACTS
Charles E. Bradley and Clayton Mc Cuistion 22 Dec. 1965 65 p refs
(Grant NsG-425)
(NASA-CR-74217) CFSTI: HC $3.00/MF $0.50 CSCL 05A

The incentive contract form is examined in terms of elementary decision theory, incorporating the contractor's utility function and the question of choice under uncertainty. This approach was taken to clarify the contractor's decision problem and to develop the necessary insight as to the value of this contract for stimulating contractor efficiency. Fundamental inconsistencies in incentive contracting are assessed, with emphasis placed on contractor risks and contract negotiations under conditions of uncertainty. A general model of contractor behavior is developed as a formal description of the approach to contract negotiations; it describes how the contractor can improve his situation with an incentive contract—not through cost efficiency efforts but through negotiations. The fee function is also examined, and several examples of contractor motivation are given. It is pointed out that experience with incentive contracts clearly indicates that cost sharing by the contractor is not sufficient to stimulate efficiency, and that there is a general absence of a potential for negotiating fee arrangements which will stimulate such efficiency. M.G.J.

N65-90192* California Univ., Berkeley. Space Sciences Lab.
COMPETITION, EFFICIENCY AND MILITARY R AND D CONTRACTS
Douglas Woodfill Mar. 1965 16 p refs *Its* Internal Working Paper No. 26
(Grant NsG-243-62)

Mechanisms of competitive enterprise; cost, technological, and production efficiency; and implications of fixed price and cost reimbursement contracts are discussed in an attempt to: (1) relate these factors to the elements which make the aerospace industry unique, and (2) assess these factors in terms of their effects on private firms having military research and development contracts. Methods for solving inherent problems associated with competitive bargaining, contractor efficiency, and contract arrangements are proposed. S.C.W.

M3 RESEARCH & DEVELOPMENT

N67-81403* California Univ., Los Angeles. Graduate School of Business Administration.
MANAGERIAL METHODS OF SUCCESSFUL PROJECT MANAGERS WITH A LOOSE REIN
George A. Steiner and William G. Ryan 15 Nov. 1965 101 p refs *Its* NASA Res. Paper No. 1
(Grant NsG-237)
(NASA-CR-71814)

A study designed to determine whether successful project managers having a loose rein used comparable managerial principles and practices. Major objectives of this study were to focus more attention on the loose rein method, to describe and analyze the managerial practices that are typically used, and to set forth advantages in the process for both the government and its contractors. Loose rein management refers to those arrangements which free a project manager from most of the detailed procedural procurement requirements placed upon him by the customer, thus allowing freedom in (1) evaluating and reviewing requirements, (2) choosing design to meet requirements, and (3) making technical and managerial decisions needed to complete the assignment. A managerial model is also described which presents basic fundamental principles and practices which must be applied for success in cutting time and cost to prototype. Major conclusions of this study were: (1) Fifteen project managers who had a loose rein from the customer (government) also had similar managerial philosophies and ran their programs on the basis of comparable principles and practices. (2) The use of the proposed model should result in a success similar to that of the project managers interviewed and therefore seems worthy of consideration by both government and industry. (3) More loose rein management arrangements should be made by government procurement agencies since important benefits can accrue (in terms of superior technical product at lower cost and in less time) from the application of this method in fairly large and complex research and development programs. S.C.W.

N67-28758*# Washington Univ., St. Louis, Mo. Dept. of Economics.
METHODS OF GOVERNMENT ASSISTANCE TO RESEARCH AND DEVELOPMENT
Murray L. Weidenbaum Jun. 1967 21 p refs *Its* Working Paper 6705
(Grant NsG-342)
(NASA-CR-84820) CFSTI: HC $3.00/MF $0.65 CSCL 05C

It has been proposed that plans for attaining rapid expansion of economic growth should emphasize speeding up technical change and innovation. This paper deals with one possibility for acceleratin such applications of science and technology: governmental encouragement of the private performance of research and development (R&D). An examination of such efforts in the more rapidly developing nations reveals that a wide variety of mechanisms exists through which governmental authorities can encourage private R&D undertakings. This study both indicates the major categories of such public aid and also presents some of the limitations to their effectiveness. Author

N67-18105*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
ANALYSIS OF PROBLEMS ENCOUNTERED IN R&D PROJECT MANAGEMENT
Roy Poust and Irwin Rubin Dec. 1966 26 p refs
(Grant NsG-235)
(NASA-CR-81761; Rept.-232-66) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Types and numbers of problems encountered in government-supported projects in the aerospace and electronics industries are analyzed by reviewing data on 32 research and development contracts. Frequencies of problems encountered by both project and laboratory managers were inversely related to the rankings of the importance of these problems, indicating that there may not be adequate reporting procedures. Rankings and frequencies of problems encountered by both project and laboratory managers are significantly correlated. Problem importance rankings associated with the job positions of project managers and of laboratory managers were not related. While the rankings of frequencies of problems by project managers and government technical monitors agreed, those for laboratory managers and monitors did not. A general problem category typology was developed from the data submitted on the 32 projects. M.W.R.

N67-18082*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
INFORMATION FLOW IN AN R AND D LABORATORY
Thomas J. Allen and Stephen I. Cohen Aug. 1966 29 p refs
(Grants NsG-235; NSF GN-233; NSF GN-353)
(NASA-CR-81753; Rept.-217-66) CFSTI: HC $3.00/MF $0.65 CSCL 05J

A sociometric study of interpersonal relations and information flow was conducted in a small research and development laboratory

engaged in work on new materials and devices in the fields of energy conversion and solid state electronics. The data were collected from 28 of the 34 professional members of the laboratory by means of written questionaire followed up by brief personal interviews. The results of the research provide substantial support for two hypotheses concerned with 1) the role of technological gatekeepers who are key individuals capable of effectively bridging the organizational boundary impedance and who provide the most effective entry point for ideas into the lab, and 2) the influence of primary groups in mediating the information flow. Various statistical percentage data compiled from the questionaires are given in tables, and the relations involving communication behavior are discussed. L.S.

N67-17861* California Univ., Los Angeles. Div. of Research.
ON ORGANIZATIONAL AGING IN AN R&D FACILITY
William H. McWhinney Jan. 1966 23 p refs *Its* NASA Res. Paper No. 4
(Grant NsG-237)
(NASA-CR-71785) CFSTI: HC $3.00 CSCL 05J

The conditions which produce organizational aging on the context of a particular research and development organization are explored for an operation which has shown at least some of the aging symptoms. Information is utilized to build a theoretical approach and to develop strategies for mitigating the various weaknesses occurring in the aging syndrome. The study is limited to consideration of personnel policies which determine the acquisition, movement within the organization, and separation of employees. Factors considered are the effects of an aging staff, staleness occasioned by familiarity, and the rigidity that is developed to protect the weaker staff members and simplify the work of administrators. S.P.

N67-13107*# California Univ., Los Angeles. Graduate School of Business Administration.
THE PRE-SOLICITATION PHASE OF GOVERNMENT R&D CONTRACTING
Gaylord E. Nichols, Jr. 15 Apr. 1966 28 p refs
(NASA-CR-80474; NASA-RP-10) CFSTI: HC $2.00/MF $0.50 CSCL 05A

The decision environment that exists during the pre-solicitation phase of research and development contracts awarded by a government agency to private contractors (specifically NASA space research and development center, and two major aerospace companies) is investigated. The report attempts to relate the effects of contractor activity at this phase to contractor selection. Examination of information derived from the above sources indicate that important competitive factors operate prior to the formal initiation of the procurement process which not only affect the project planning and initiation, but also heavily influence the eventual selection of a specific contractor. This early activity is considered to be sufficiently pervasive in the procurement process to be given the status of a distinct phase in the procurement cycle (the pre-solicitation phase). L.S.

N67-11339*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
RESEARCH PROGRAM ON THE MANAGEMENT OF SCIENCE AND TECHNOLOGY Annual Report, 1964–1965
Donald G. Marquis Jul. 1965 58 p refs
(Grant NsG-235)
(NASA-CR-79701) CFSTI: HC $3.00/MF $0.50 CSCL 05A

A summary is presented of the progress and plans of a program of research and education on the problems of organizing and managing large scale technology based enterprises. Studies are focused on the objectives of understanding and improving the effectiveness of research and development activities and the use of science and technology for general welfare. Discussions are included on problem solving; organization and management of large projects; individual impersonal factors in research and development; research institutions; government contracting for research and development; sources and uses of new technology; economic and social effects of new technology; and educational activities. H.S.W.

N66-82836* Stanford Research Inst., Menlo Park, Calif.
THE STRUCTURE AND DYNAMICS OF THE R AND D INDUSTRY WITH SPECIAL REFERENCE TO NASA PROGRAMS IN THE LOS ANGELES AREA
Dec. 1965 17 p ref
(Contract NASr-49(21))

This production factor study compares a group of space-oriented establishments in Los Angeles with other aerospace R & D establishments by evaluating collected data on 7,408 engineers and scientists working full time on space projects. The work force composition was analyzed for educational level, age, sex, marital status at time of hire, geographic flow, and salary. Overall, the range of salary increases was higher for personnel in space-oriented establishments than for those in other aerospace R & D establishments. Procurement patterns for NASA-related and DOD-related contracts were mostly similar for a Los Angeles as well as for a Boston company. G.G.

N66-35974*# George Washington Univ., Washington, D. C.
PRODUCTIVITY OF FEDERALLY FINANCED RESEARCH AND DEVELOPMENT Final Report, May 15, 1963–May 14, 1966
Donald S. Watson [1966] 12 p
(Grant NsG-425)
(NASA-CR-77776) CFSTI: HC $0.00/MF $0.50 CSCL 05A

Four studies conducted under the auspices of NASA are discussed: (1) a study of patents resulting from government-financed research and development, with data categorized as to personnel, federal agencies, and patent policies; (2) a study of the concentration of patents from government-financed research in industry, which treats government contract policies, monopoly power, and patent generation by 177 major contractors during a 17-year period; (3) a study of the federal government's propensity to patent, which analyzes the relative decrease in patents during the postwar period despite the increase in the number of scientists, engineers, and the greatly increased financial outlay; and (4) an incomplete study of the concentration of patents owned by domestic corporations, which spans four decades. K.W.

N66-14577*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
TIME ALLOCATION AMONG THREE TECHNICAL INFORMATION CHANNELS BY R AND D ENGINEERS
Thomas J. Allen and Maurice P. Andrien, Jr. Aug. 1965 23 p refs *Its* Rept.-131-65
(Grant NsG 235-62; NSF GN-233; NSF GN-353)
(NASA-CR-69091) CFSTI: HC $1.00/MF $0.50 CSCL 05B

Four government funded parallel research and development projects are examined to determine the manner in which engineers and scientists allocate their time, and the effect of this allocation on the outcome of the projects. The use of matched pairs of projects allows the relative evaluation of outcomes by technical monitors in the customer agencies. The percent of total time spent in three categories of information gathering (outside consultation, staff consultation, and literature search) varies significantly over the life of a project. Higher rated teams are relatively stable in all phases of information gathering while lower rated teams initially

spend far more time gathering information than they do in the later stages and fluctuate more throughout the project. Subsystems characterized by greater uncertainty receive a higher percent of information gathering time than subsystems where uncertainty is lower. Author

N66-14419*# Stanford Univ., Calif. School of Engineering.
A STUDY OF THE UNIVERSITY ROLE IN ENGINEERING RESEARCH FOR NASA PARTICULARIZED TO THE STANFORD UNIVERSITY CASE Final Report
25 Jun. 1965 136 p refs
(Grant NGR-05-020-069)
(NASA-CR-68968) CFSTI: HC $4.00/MF $1.00 CSCL 05I

A study report is given on the university role in engineering research, and an examination of research practices, program character, attitudes of the faculty and students, and the administrative problems in carrying out a NASA program in a particular school of engineering. Although the study was made in the context of the Stanford University engineering community, other inputs were used, and many of the results are believed to have a general applicability to NASA-University relations. In the course of the study detailed quantitative information was accumulated through structured interviews with research-oriented engineering faculty members, and other less formal interviews with additional members of the faculty and with students. Detailed conclusions are given concerning engineering students and teaching; research and graduate education; character and organization of faculty research; university contributions to space flight projects; university-community interaction and spin-off; and NASA funding of university research. C.T.C.

N66-14417*# California Univ., Berkeley. Space Sciences Lab.
THE ROLE OF THE RESEARCH ADMINISTRATOR
C. W. Churchman, C. E. Kruytbosch, and P. Ratoosh Oct. 1965 16 p refs *Its* Internal Working Paper No. 38
(Grant NsG-243-62)
(NASA-CR-68969) CFSTI: HC $1.00/MF $0.50 CSCL 05A

This paper reports a preliminary attempt to characterize a number of role orientations among research administrators by means of a series of self-administered rankings of the functions they perform. Mutually exclusive administrative and research orientations appeared in the rankings. The former stressed administrative control and planning functions and deemphasized involvement in scientific and technical activities, and human relations functions; the researchers reversed these positions. A further managerial orientation stressed planning and human relations functions and placed low value upon research and administrative control. The sample was too small to permit significant correlations between the role orientations and organizational and career variables. A striking feature of the rankings was that respondents who had held their positions for several years were more consistent in the various rankings than were more recent arrivals. This strongly suggests a developmental pattern to the role orientations. Author

N66-12194*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
SOURCES OF IDEAS AND THEIR EFFECTIVENESS IN PARALLEL R & D PROJECTS
Thomas J. Allen Jul. 1965 26 p refs Presented at the 2d ONR Conf. on Res. Program Effectiveness, Washington, D. C., 28 Jul. 1965 *Its* Working Paper No. 130-65
(Grants NsG-235-62; NSF GN-233; NSF GN-353)
(NASA-CR-68156) CFSTI: HC $2.00/MF $0.50 CSCL 05B

Seven sets of parallel R & D projects involving 15 laboratories are examined. Data gathered by Solution Development Records—a form which provides a weekly estimate of the probability of adoption of the approaches under consideration as possible solutions to a technical problem—and post-project interviews with the engineers responsible for each problem. The sources of technical approaches, indicated on the Solution Development Records, were obtained during the post-project interviews. Eight possible sources of ideas are considered. Better performing groups are found to rely more than poorer performers upon information sources within the laboratory, for generation of ideas. A serious misalignment appears to exist between the quality of ideas generated through the eight channels and the frequency with which these channels are used by engineers. Vendors and analysis and experimentation, by the engineer himself, appear to be over-utilized relative to their effectiveness as idea sources, while information available from other company research programs and from the lab's technical staff is under-utilized. Author

N66-10635*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
RESEARCH PROGRAM ON THE ORGANIZATION AND MANAGEMENT OF R AND D. PROBLEM SOLVING STRATEGIES IN PARALLEL RESEARCH AND DEVELOPMENT PROJECTS
Thomas J. Allen Jun. 1965 28 p refs
(Grant NsG-235)
(NASA-CR-67767) CFSTI: HC $2.00/MF $0.50 CSCL 14A

Three pairs of parallel R&D projects are examined. The data analyzed were gathered by means of Solution Development Records—a form which provides a weekly estimate of the probability of adoption of the approaches under consideration as possible solutions to a technical problem. It is found that the longer an approach is indicated by these forms to be in a favored position, the more difficult it is to reject. Furthermore, the number of alternative technical approaches considered bears a relation to judged solution quality. Groups producing higher-rated solutions generated fewer approaches during the course of the project, and they more closely approach an ideal strategy of approaches off on a two-at-a-time basis than do their poorer performing rivals. Author

N66-10633*# Massachusetts Inst., of Tech., Cambridge. Alfred P. Sloan School of Management.
RESEARCH PROGRAM ON THE ORGANIZATION AND MANAGEMENT OF RESEARCH AND DEVELOPMENT. QUESTIONING THE COST/EFFECTIVENESS OF THE R AND D PROCUREMENT PROCESS
Edward B. Roberts Sep. 1965 27 p refs Presented at the 2d Conf. on Res. Program Effectiveness, Office of Naval Res., Washington, 28 Jul. 1965
(Grant NsG-235)
(NASA-CR-67766) CFSTI: HC $2.00/MF $0.50 CSCL 14A

Presented are results of a cost/effectiveness evaluation of the Research and Development procurement process which controls the awards of over $8 billion annually of government sponsored research and development contracts to industry, universities, and nonprofit organizations. Analyzed are data received via brief questionnaires which asked the following questions: (1) Who are the winners of research and development contracts? (2) What are the key determinants of the awards to these winners? (3) Compared with possible alternatives, what are the benefits of the present R&D procurement process? (4) Compared with possible alternatives, what are the costs of the present R&D process? S.C.W.

N65-90235* Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
THE INFLUENCE OF SEVERAL ORGANIZATIONAL FACTORS ON THE IDEA GENERATION AND SUBMISSION BEHAVIOR OF INDUSTRIAL RESEARCHERS AND TECHNICIANS
Norman R. Baker (Ph.D. Thesis) Jan. 1965 4 p
(Grants NsG-495; NSF G-24442)

Presented is a hypothetical study on the effects of time pressures, intrinsic and extrinsic rewards and costs, interaction with other laboratory personnel, and organizational goals, objectives, and needs on idea generation and submission behavior of industrial researchers and technicians. As hypothesized, the following was indicated: (1) perceived time pressures due to work loads influenced idea originator behavior by focusing thinking on current work and by modifying perceptions of the intrinsic and extrinsic rewards and costs associated with idea generation and submission. (2) Managements behavior towards previously submitted ideas was found to influence the perceptions held by the researchers and technicians of the rewards and costs associated with idea generation and submission. (3) Perceptions of organizational goals, objectives, and needs tended to stimulate ideas perceived to be relevant to these goals, objectives, and needs, and to influence which ideas would be submitted. (4) Researchers and technicians formed their perceptions of organizational goals, objectives, and needs partially by interaction with other laboratory personnel (support) and management's behavior with respect to previously submitted ideas (weak support). It is surmised that the above factors are critical in explaining, understanding, and predicting important aspects of idea generation and submission behavior of industrial researchers and technicians. S.C.W.

N65-88511* George Washington Univ., Washington, D. C.
GOVERNMENT RESEARCH AND DEVELOPMENT INVENTIONS—A NEW RESOURCE?
Mary A. Holman Repr. from Land Econ., Vol. 41, No. 3, Aug. 1965 p 231–238 refs
(Grant NsG-425)

Statistics on the generation and ownership of patents by the federal government and government contractors are reviewed, and the commercial use of these patents is defined. The consequences of present patent policies and the potential benefits for the economy are briefly discussed. K.W.

N65-29430*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH AND DEVELOPMENT ECONOMICS
J. J. Phillips, Jr. [1964] 14 p refs Presented at Liquid Propulsion Symp., LPIA, Los Angeles, 23 Sep. 1964
(NASA-TM-X-51989) CFSTI: HC $1.00/MF $0.50 CSCL 05C

The future status of research and development, and its effect on the total economy is assessed. The impact of the cybernetic revolution, particularly in relation to clerical, middle management, design and service functions, and of technology advances on economic parameters and political thinking are also discussed. The rise in federal R & D expenditures since 1930 is tabulated, and a comparison made between federal and total expenditures. Expenditures for R & D by various government agencies are reviewed, and predictions made as to future trends. Foreign competition is discussed, and the role of American business in determining the course the economy will take is emphasized. M.G.J.

N65-26424*# Massachusetts Inst. of Tech., Cambridge. School of Industrial Management
THE DESIGN OF RESEARCH AND DEVELOPMENT POLICY
Edward B. Roberts 16 Jan. 1963 42 p refs
(Grant NsG-235-62)
(NASA-CR-63406) CFSTI: HC $2.00/MF $0.50 CSCL 05A

Problems of research and development managers demand a management laboratory for the design and testing of new policies. This laboratory approach is now possible based on the concepts and methodology of Industrial Dynamics and on a new systems framework for representing project life cycles. The bases for a behavioral model of R and D projects are presented, as are some results of the computer simulation studies of the model. Conclusions drawn from these investigations suggest the important of risk-taking and integrity of R and D organizations, and also indicate several areas in which government procurement policies seem self-defeating. Author

N65-26415*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management
THE ULTILIZATION OF INFORMATION SOURCES DURING R&D PROPOSAL PREPARATION
Thomas J. Allen Oct. 1964 34 p refs Sponsored by NASA
(Grant NSF GN-233)
(NASA-CR-63407) CFSTI: HC $2.00/MF $0.50 CSCL 05B

Twenty-two proposal competitions for government R&D contract, involving 156 proposal teams, are examined to determine the relative use of three sources of technical information. The extent to which each proposal team relied upon literature search, the use of staff specialists within the lab and the use of outside sources of information is related to the rated technical quality of its proposal, and to other variables characterizing the proposal team and its parent laboratory. Twenty-two percent of the total time expended by 156 proposal teams was devoted to the seeking and gathering of technical information. Of the three information sources used, only one, laboratory specialists, appears to be at all directly related to the technical quality of the product and this relation is weak and unreliable. Technical quality is inversely related to the extent to which the proposal team relies upon individuals outside of the laboratory as sources of information. Author

N65-19750*# Missouri Univ., Columbia. Research Center
SCIENTIFIC RESEARCH IN MISSOURI
Donald A. Murry Feb. 1965 106 p refs *Its* Ser.-5
(Grant NGR-26-004-012)
(NASA-CR-57232) CFSTI: HC $4.00/MF $0.75

Missouri's scientific research activities, recent expansion of research and development activity in the United States, expansion of scientific research in Missouri, scientific talent in regional research and development expansion, and scientific talent resources in Missouri and selected states are reviewed. It was concluded: (1) Despite the dominance of an individual state industrial contractor in space research, there appears to be little overall strength in research and development at this time in Missouri. (2) If a viable scientific research industry is sought for Missouri, the role of catching up indicates that a considerable quantity of scientific resources, with some specific characteristics, must be made available. E.E.B.

N63-86063* National Aeronautics and Space Administration, Washington, D. C.
THE CREATION OF A GOOD RESEARCH ENVIRONMENT
Ira H. Abbott 11 Dec. 1961 13 p Presented at Seminar on Res. Planning and Management, Princeton, N. J., 29 Aug. 1961

The intangible variables which stimulate and challenge the creative scientist are discussed, and several specific factors considered necessary in creating a productive research environment are considered. These include (1) the degree to which opportunity and freedom exist for engaging in original research; (2) the opportunities for professional recognition; and for self-improvement

and growth within the organization; (3) the quality of management; (4) the degree of interest engendered by the research program; (5) organizational prestige; (6) salary range; and (7) physical environment and geographical location. M.G.J.

M4 MANAGEMENT TOOLS & TECHNIQUES

N67-81734* U. of S. Cal., L. A.
PERT AND PROCUREMENT POLICY
Jack C. Hayya 21 Jan. 1966 118 p refs
(NSG-237)
(NASA-RP-8)

Due to growing indications of industrial dissatisfaction with government emphasis on PERT as the major planning and control technique in the procurement process, a study was conducted to establish a basis for a rational solution to the problems associated with its use. A literature survey was undertaken, including government directives and memoranda; depth interviews were held with aerospace industry and government personnel; and a comprehensive questionnaire was sent to aerospace firms and systems project offices using PERT. The quantitative analysis is based on 27 projects reported for PERT/time and 34 for PERT/cost. Based on the results, four recommendations are proposed: (1) PERT should be required in cost-reimbursement contracts only, and (2) in R and D and military construction programs only. (3) The threshold contract price that makes the use of PERT/time mandatory should be $10 million; that for PERT/cost should be $15 million. (4) The work content of the lowest level work package in the PERT/cost work breakdown structure must be well defined and of such size that it can be managed by one man or one department. M.G.J.

N67-36770*# Bellcomm, Inc., Washington, D. C.
CONFIGURATION MANAGEMENT OF COMPUTER PROGRAMS
Burt H. Liebowitz 6 Apr. 1967 13 p refs Presented at the 4th Space Congr., Cocoa Beach, Fla., Apr. 1967
(Contract NASw-417)
(NASA-CR-88490) CFSTI: HC $3.00/MF $0.65 CSCL 09B

Proposed is the extension of configuration management procedures which were originally formulated for use in hardware production to the production of computer programs. It is shown that these procedures promote more effective management control by requiring: (1) The development of a two-part computer program specification the first part of which defines the requirements of the program, the second part of which describes the resultant program; (2) Reviews of the design and implementation of the computer program; (3) The control of changes to the specification and the resulting computer program; and (4) The maintenance and updating of the computer program specification and other supporting documents. Author

N67-35848*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PRODUCTION CONTROL AND ACCOUNTING SYSTEM
Donald E. Jamison Dec. 1966 105 p refs
(NASA-TM-X-55891; I-564-66-595) CSCL 09B

A study of the methods of production control and accounting information storage used by the Data Processing Branch at Goddard Space Flight Center is presented. An alternate method of automating many of the functions of the present data handling system is discussed. Many of the repetitive tasks associated with punched cards have been eliminated and the accounting data has been consolidated for instant access. The study has shown how an available, government owned computer, the IBM 1401 can be utilized effectively to meet the current system requirements and still have the capability for expansion. This results in two fold savings for NASA, in that it takes advantage of existing equipment, and higher priced computer systems that should be used for direct support of GSFC's scientific missions. Author

N67-32566*# Texas A&M Univ., College Station. Graduate Coll.
AN OPTIMIZATION PROCEDURE FOR NETWORK PLANNING SYSTEMS
Orlando Sia Madrigal (M.S. Thesis) May 1967 102 p refs
(Contract NAS9-4318)
(NASA-CR-65644) CFSTI: HC $3.00/MF $0.65 CSCL 05A

A time compression algorithm for the critical path method of planning and controlling large management projects is evaluated and a computer program developed that eliminates the necessity of enumerating all possible combinations for time compression in cases where more than one critical path exists in a network. The present state of the development computer program is only applicable to medium-sized projects. The total projection duration has an associated cost function dual to the activity cost function; the routine depends upon the time interval used in compression. G.G.

N67-19903*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.
COST EFFECTIVENESS: INCENTIVE STIMULANT FOR FUTURE SPACECRAFT PROGRAMS
Edward D. Lupo 4 Nov. 1965 28 p
(NASA-TM-X-59453) CFSTI: HC $3.00/MF $0.65 CSCL 22A

The contribution that operations research techniques can make to the effective operation of future spacecraft programs is discussed. A detailed study was undertaken to investigate the advantages and disadvantages of the various proposed concepts for earth orbital experimentation. Part of the result of this investigation was concerned with a gross level analysis of the effect of the major system parameters of the concepts on the cost effectiveness of the total program. Major steps taken and the major conclusions reached are outlined. It is shown that although the techniques of cost effectiveness analysis are not new, they are useful in aiding decision making. There is a growing emphasis in space program planning to use such techniques to eliminate uneconomical methods of mission accomplishment by applying the techniques at the program level. Even in the relative uncertainty and instability of planning for future manned space flight programs, the logic of cost effectiveness analysis can and will contribute significantly to economical spacecraft operations. R.N.A.

N67-18416* Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF A MATHEMATICAL MODEL OF THE HUMAN OPERATOR'S DECISION-MAKING FUNCTIONS Final Report
J. T. Tou, R. E. Thomas, and R. J. Cress 31 Oct. 1966 233 p refs
(Contract NAS12-37)
(NASA-CR-80009) CFSTI: HC $3.00 CSCL 05H

Attempts are made to formulate a mathematical model describing the human operator's decision-making functions in a control system. The model simulates the evolution of control strategies selected by a human operator and the prediction of verbal heuristics used by such an operator. The proposed model consists of four modes of control: heuristic, gradient, terminal, and probing modes. The operator is assumed to be engaged in the on-line control of a dynamic system described by an ordinary linear differential equation subject to initial and final boundary conditions. The task consists of moving the system from the initial state to the terminal state and minimizing a quadratic performance criterion using information concerning state variables and cost variables

which is obtained from meter readings available at discrete time during the control operation. The approach used was to allow 14 subjects to solve 23 first-order control problems (Mark I model) and allow 14 additional subjects to solve 12 second-order control problems (Mark II model). Results from the computer simulation and those from tests of subjects are analyzed. S.P.

N67-18014*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
THE EFFECTS OF PERT ON R&D ORGANIZATIONS
Wyckham D. Seelig and Irwin M. Rubin Dec. 1966 16 p refs *Its* Working Paper 230-66
(Grant NsG-235)
(NASA-CR-81725) CFSTI: HC $3.00/MF $0.65 CSCL 05A

The study reported was conducted on projects in aerospace and electronics industries with contracts greater than $1 million. The methods of collecting information on cost and schedule performance, technical performance, and communication are described, and the results are tabulated and discussed. It was concluded that PERT leads to improvement of cost/schedule performance while at the same time technical performance is not noticeably affected. Improved communication with the use of PERT is also indicated. N.E.N.

N67-13880*# California Univ., Los Angeles.
A MANAGEMENT MODEL FOR SELECTING MAJOR SUBCONTRACTORS IN THE AEROSPACE INDUSTRY
Edmund R. Gray (La. State Univ.) Apr. 1966 30 p refs Sponsored by NASA NASA Res. Paper No. 9
(NASA-CR-80762) CFSTI: HC $2.00/MF $0.50 CSCL 05A

A model of the management decision process for selecting major subcontractors in the aerospace industry is presented. The study is directed specifically toward aerospace executives involved in subcontractor selection decisions. Other interests include an example of a model building technique for approaching complex recurring decision situations. C.T.C.

N67-12986*# Texas A&M Univ., College Station.
QUANTIFICATION AND UTILIZATION OF SUBJECTIVELY DETERMINED DATA IN THE CONSTRUCTION OF MATHEMATICAL MODELS
Grady Lee Haynes (M.S. Thesis) Aug. 1966 91 p refs
(Grant NGR-44-001-027)
(NASA-CR-80349) CFSTI: HC $3.00/MF $0.75 CSCL 09B

The development of a model based on the opinions of experts which can be used to obtain information pertinent to the models that are being applied to management and planning decisions for futuristic processes is discussed. The method resembles past efforts in that it uses subjectively determined data as a basis for decisions. Of the two major attempts at using this form of data, DELPHI and PATTERN, the method more closely resembles the former, borrowing from it the technique of non-confrontation of the judges. Resemblance to PATTERN comes from the fact that, while not attempting to rank, the judges are asked to choose one answer from a group of possible answers as being the best. Variance estimates are made, allowing the calculation of confidence bands around the estimates. In an experiment the model was utilized in an attempt to predict cost-time functions for the various cost categories involved in future space programs. C.T.C.

N66-38746*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A MANAGEMENT PLAN FOR SYSTEMS ASSURANCE DURING PHASES A, B, C, AND D
Preston T. Farish 14 Sep. 1966 40 p
(NASA-TM-X-53516) CFSTI: HC $3.00/MF $0.65 CSCL 05A

This plan establishes a sound, practical management tool for use in coordinating the products, efforts, and functions of the four following major support disciplines throughout phases A, B, C, & D of a system development: (1) human engineering, (2) maintainability, (3) reliability and quality, and (4) system safety. It is arranged in two sections which describe the organizational relationships and responsibilities, and the functional working relationships. The objective of this plan is to present management techniques that can be used in guiding the activities of the above disciplines into a team effort. It also insures that maximum application is made of the respective technologies to provide NASA with comprehensive management visibility. Author

N66-37543*# Washington Univ., St. Louis, Mo. Dept. of Economics.
PROGRAM BUDGETING AND THE SPACE PROGRAM
Murray L. Weidenbaum Sep. 1966 21 p refs *Its* Paper 6607
(Grant NsG-342)
(NASA-CR-78386) CFSTI: HC $1.00/MF $0.50 CSCL 05A

The implementation of the Planning-Programming-Budgeting System (PPBS) by all major Federal Government agencies presents both important opportunities and major problems to the Nation's space program. The first part of this paper describes the main features of the PPBS effort. The second part analyzes possible applications to and impacts on space activities. Author

N66-34069*# California Univ., Berkeley. Space Sciences Lab.
ON LARGE MODELS OF SYSTEMS
C. West Churchman Jun. 1966 22 p Presented at 2d Stony Brook Conf. on Advances in Computing, N. Y., Jun. 1966 *Its* Internal Working Paper No. 39
(Grant NsG-243-62)
(NASA-CR-77105) CFSTI: HC $1.00/MF $0.50 CSCL 05K

A theoretical discussion is presented of difficulties in attempts to rationalize large social systems, such as governments, industrial firms, universities, or hospitals by search for central quantitative measures of system performance. These measures, or desirable qualities, are then related to the feasible activities of the particular system in order to enhance man's understanding of the system; and the mathematics which relates these activities to the desirable quantities is dubbed an objective function Objective functions can then be maximized by use of constraint equations. While the problems inherent in rationalizing human systems by large models are many, it is emphasized that we should not abandon efforts in this direction. M.W.R.

N66-29571*# George Washington Univ., Washington, D. C. Program of Policy Studies.
PLANNING, PROGRAMMING AND BUDGETING: A TECHNIQUE FOR FEDERAL PROGRAM PLANNING AND DECISION-MAKING
Robert G. Smith 24 Nov. 1965 32 p refs
(Grant NsG-727)
(NASA-CR-75897) CFSTI: HC $2.00/MF $0.50 CSCL 05A

A Presidential proposal for the adoption of a planning–programming–budgeting system by key government agencies is discussed, and its evolution and possible impact is analyzed. The integrated programming and budgeting system introduced into the Department of Defense, which resulted in more centralized decision-making, is assessed, and its impact on the defense industry is considered. The proposed system is defined as a management technique for systematically defining primary objectives and alternatives, then matching these objectives and alternatives to the appropriate resources within

a structured information matrix. The technique is designed to assist top management in its planning, decision-making, and directive responsibilities. Inherent in the plan is a complex analytical process defined as systems, cost/utility, or cost effectiveness analysis. The current appropriations structure is compared with the suggested program structure for the Federal Transportation Program as an example of the changes which are involved. Details are also given on the proposed annual budget cycle which would operate over a 12-month period. Personnel acceptance or rejection of the system is viewed as a problem, and possible solutions are proposed. M.G.J.

N66-27753*# Washington Univ., St. Louis, Mo. Dept. of Economics.

PROGRAM BUDGETING: APPLYING ECONOMIC ANALYSIS TO GOVERNMENT EXPENDITURE DECISIONS

Murray L. Weidenbaum Apr. 1966 29 p refs *Its* Paper No. 6602

(Grant NsG-342)

(NASA-CR-75492) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This paper discusses the new Planning-Programming-Budgeting System (PPBS) of the Federal Government, which represents a major advance in the application of economic analysis to public finance decision making. Antecedent developments in the economic analysis of governmental expenditure decisions are reviewed and related to the current budget reform movement. The PPBS is based on the introduction of three major concepts into Federal Government operations: the development in each government agency of an analytical capability to examine in depth both agency objectives and the various programs to meet these objectives, the formation of a five-year planning and programming process coupled with a sophisticated management information system, and the creation of an improved budgeting mechanism which can take broad program decisions, translate them into more refined decisions in a budgetary context, and present the results for presidential and congressional action. The framework of the system, some long term impacts, and future prospects are also discussed. R.N.A.

N66-10561*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

PROCEEDINGS OF NASA/INDUSTRY PERT COMPUTER CONFERENCE

[1964] 171 p Conf. held in Houston, 22–24 Jul. 1964

(NASA-TM-X-56870) CFSTI: HC $5.00/MF $1.00 CSCL 09B

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N64-24892* General Electric Co., Santa Barbara, Calif.

PLANNING A LEAST COST RELIABILITY CONSTRAINED DEVELOPMENT PROGRAM: A CAPACITATED NETWORK APPROACH

Paul M. Carrick, Jr. N.Y., AIAA [1964] 10 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.-2 Jul. 1964

(Contract NASw-686)

(AIAA Paper-64-410) AIAA: $0.50 members, $1.00 nonmembers

This paper presents the results obtained to date in developing a method for estimating the resource requirements for any future, technically complex, development program. Specifically, the approach is designed to provide a minimum cost test plan that will assure conformance to the reliability requirements and that, in addition, will satisfy the reliability constraint during the conduct of the more usual engineering experimental investigations. The proposed planning approach overlaps two categories of current research: First, it represents a slight extension of PERT-Cost logic in that it deals with selecting the least-cost development path from a rather large set of alternative paths, which are themselves defined by the existence of substitutability between resource inputs. Secondly, it represents a radical reorientation of the techniques for assuring conformance to the reliability requirements placed upon a program. Author

N64-18450* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

A TECHNIQUE FOR ESTIMATING FUNDING AND MANPOWER REQUIREMENTS FOR RESEARCH AND DEVELOPMENT LONG-RANGE PLANNING

Frank E. Goddard, Jr., William H. Bayley, David K. Carlisle, James R. Edberg, and Fred H. Felberg 8 Nov. 1962 19 p

(NASA Contract NAS7-100)

(NASA CR-53571; JPL Planning Rept. 35-6 (Rev. 1)) OTS: $1.60 ph

This report outlines the technique that has evolved from a study of the long-range programing problem. The material is extracted from an internal planning report and is presented only as one method by which estimates of resource requirements can be made. Charts and figures required to understand the technique are presented, together with a simplified step-by-step procedural example showing how estimated requirements are determined for a given project that, in itself, is a component part of a program and of the overall installation effort. Author

N62-16057*# Office of the Secretary of Defense, Washington, D. C.

DOD AND NASA GUIDE PERT/COST SYSTEMS DESIGN

June 1962 150 p refs

GPO: $0.75

The performance Evaluation and Review Technique (PERT) System is expanded to incorporate the schedule and cost data needed by contractor and government management to identify present and projected trouble spots. R.C.M.

M5 PERSONNEL MANAGEMENT

N67-85461* Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
CAREER ORIENTATIONS AND PERCEPTIONS OF REWARDED ACTIVITY IN A RESEARCH ORGANIZATION
Edgar H. Schein, William Mc Kelvy, David Peters, and John Thomas May 1964 23 p refs
(Grant NsG-235)
(NASA-CR-87535; Rept.-56-64)

Ninety-six open-ended interviews were coded to measure career orientations of scientists and engineers in a formal research organization. Responses were categorized into two career identification dimensions (institutional–noninstitutional and technical–managerial), and three career style dimensions (active–passive, idealistic–cynical, and task–interpersonal). The responses were also categorized with respect to perceptions of rewarded activity into four variables: technical performance, personality, visibility, and organizational circumstances. The low degree of correlation among the orientation dimensions supports the conclusion that a profile based on these dimensions may be a more accurate and useful depiction of orientations than single dimensions. The data show no correlation between the managerial orientation and the institutional orientation, possibly a reflection of the increased professionalization of supervisory personnel. Correlations between career orientations and perceptions of rewarded activity tended to be low, suggesting that these are independent variables. Author

N67-81477* Massachusetts Inst. of Tech., Cambridge.
PROJECT MANAGEMENT AND THE ROLE OF THE PROJECT MANAGER
Irwin M. Rubin Oct. 1966 15 p refs
(Grant NsG-235)
(NASA-CR-82149; Rept.-222-66)

The study reported in this paper focuses first on the relationship between a project manager's background characteristics and certain characteristics of the projects he is asked to manage. The impact of this decision process is then examined by relating project manager traits and project characteristics to a measure of project performance. It appears that organizations select their oldest, more experienced project managers to head-up large, high priority projects. Performance is thus improved, not because of the project manager's prior experience, but because of the high priority given larger projects. With the exception of a measure of growth in responsibility none of the project manager traits measured were found to bear any direct relationship to project performance. Author

N67-39239*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PERSONNEL MANAGEMENT IN R AND D ORGANIZATION: AN ANALYSIS OF THE PHASEDOWN OF THE GEMINI PROGRAM OFFICE AT THE MANNED SPACECRAFT CENTER
Joan B. Coil (Minn. Univ.) 31 Aug. 1967 75 p refs
(NASA-TM-X-60470; MSC-BM-MR-67-3) CFSTI: HC $3.00/MF $0.65 CSCL 22A

This report analyzes and discusses problems the NASA Manned Spacecraft Center experienced when faced with the completion of both the Mercury and the Gemini Program. The report describes the processes used in phasing down the Mercury and Gemini Program Offices. In the phasedown of the latter office, a questionnaire was prepared and administered to the affected employees. The results of this and other analyses are summarized and a set of conclusions and recommendations drawn from them. Author

N67-39199*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TENTATIVE PROGRAM FOR RESEARCH AND ANALYSIS OF ORGANIZATIONAL BEHAVIOR AND ADMINISTRATION OF SCIENTIFIC AND ENGINEERING FACILITIES
R. S. Juralewicz (Minnesota Univ.) 31 Aug. 1967 19 p refs
(NASA-TM-X-60441; MSC-BA-MR-67-1) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Presented are ideas and concepts on a possible approach for the investigation and study of scientific and engineering facilities based essentially on a collection of thoughts stemming from current literature on research management and management of scientific personnel. Although the orientation of the approach is bahavioral, an attempt was made to incorporate traditional or conventional management concepts and to employ a total systems concept to the study. The main objectives of this research project are: (1) to develop a research model for in-depth study of organizational modes and management techniques existing in research and engineering facilities; (2) use the model to analyze existing facilities or laboratories; and (3) identify the strengths, weaknesses, and functional characteristics of the facility's organization, making recommendations where applicable. This paper outlines a tentative program and an approach leading to the solidification of a research format to achieve these objectives. K.W.

N67-34202*# Massachusetts Inst. of Tech., Cambridge.
MOTIVATION OF R AND D ENTREPRENEURS: DETERMINANTS OF COMPANY SUCCESS
Herbert A. Wainer and Irwin M. Rubin Jan. 1967 20 p refs
(Grants NsG-235; NsG-496)
(NASA-CR-87442; Rept.-234-67) CFSTI: HC $3.00/MF $0.65 CSCL 05J

The relationships between the entrepreneurs' need for achievement, need for power, and need for affiliation were related to the performance of the eighteen small companies they founded and operated. The results indicate that the entrepreneurs' need for affiliation is not a significant factor in determining company performance. However, high need for achievement and moderate need for power are associated with high company performance. High need for achievement seems to be a necessary condition for high performance whereas moderate need for power seems to make it more probable. The influence of need for power on performance seems to be derived through its determination of leadership styles. High need for power appears to be indicative of an authoritarian and low need for power indicative of a laissez-faire style of leadership. On the other hand moderate need for power seems to be indicative of a democratic style of leadership. Author

N67-30860*# California Univ., Berkeley. Space Science Lab.
A STUDY OF SIMULATION-AIDED ENGINEERING DESIGN
Ian Mitroff Jun. 1967 343 p refs
(Grant NsG-243)
(NASA-CR-85857; NASA-WP-66) CSCL 05J

Problems confronting the analyst of the engineering design process are defined, and proposed methods for studying design are critically evaluated. It is shown how the formulation of the problem and the interpretation of the results change with the development of the study, and with the investigator's growing recognition of the importance of behavioral factors in the design process. In the case study presented, emphasis is focused on the behavior of a design engineer before and after computer simulation of his own design behavior; the engineer's response to the simulation is documented. The design task's technical and behavioral content is described, and it is demonstrated that there are no

more basic behavioral variables than the personality of the client for whom the engineer designs, and the personality of the engineer. The construction and structure of the simulation model are explained. The behavioral theory of simulation is discussed. General problems of testing simulation models are examined, and the results applied to evaluating the simulation. The Fortran IV listing, and a reference bibliography are included. M.G.J.

N67-27512*# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.

CONTROL MECHANISMS IN THE IDEA FLOW PROCESS: MODEL AND BEHAVIORAL STUDY

Jack Siegman, Norman R. Baker, and Albert H. Rubenstein Jun. 1966 36 p refs

(Grants NSG-495; NSF-G-2442)

(NASA-CR-84478) CFSTI: $3.00 CSCL 20D

A series of field studies on the generation and communication of ideas for new R and D projects has been under way for two years. In this paper, attention is focused on the formal and informal organizational control systems which affect this process. In particular, data are presented on patterns of communicating ideas between the originator and other members of the organization and patterns of submitting ideas to the laboratory's decision-makers for approval and funding. Some data are presented on latent ideas which are considered "good" by the originators but which are not communicated and/or submitted for approval to management. Author

N67-18975*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.

THE DIFFERENTIAL PERFORMANCE OF INFORMATION CHANNELS IN THE TRANSFER OF TECHNOLOGY

Thomas J. Allen Jun. 1966 30 p refs Presented at the MIT Conf. on Human Factors in the Transfer of Technol., 19 May 1966 *Its* Working Paper 196-66

(Grants NsG-235-62; NSF GN-233; NSF GN-353)

(NASA-CR-82400) CFSTI: HC $3.00/MF $0.65 CSCL 05A

The manner of information dissemination among engineers and scientists, and the impact which various information gathering practices have upon the quality of the research were investigated. A parallel research project was studied and the results are presented. Pre- and post-project interviews with individual scientists and engineers were conducted, and a record over a period of time of the progress of an individual or group was obtained. The information channels were divided into groups of intra- and inter-laboratory organizations. The principal conclusions are: (1) There is a serious misalignment between the quality of the ideas generated through the channels, and the frequency with which these channels are used by engineers. (2) Literature is not greatly used, and is mediocre in performance. (3) Better performing groups rely more upon sources within the laboratory. (4) A mismatch in information coding schemes appears to be responsible for in the ineffectiveness of communication across the organizational boundary. N.E.N.

N67-17990*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.

DECISION-MAKING IN SMALL GROUPS—A SIMULATION STUDY

Geoffrey P. E. Clarkson May 1966 147 p refs

(Grant NsG-235)

(NASA-CR-81655) CFSTI: HC $3.00/MF $0.65 CSCL 05J

Research was conducted to develop a theory of group decision making behavior. Five problems were identified. The first concerned determining whether the basic unit for the theory ought to be the group or its individual members. The approach chosen was to focus upon the individual. The next question was to resolve how to determine the decision behavior of the individuals. The solution proposed was to give the theory of individual behavior the task of learning to behave like the subjects in question. The next two problems were concerned with identifying the leader-follower relation and the effects on decision behavior of the group decision process. The theory resolved the former by assigning as leader the more conservative member of each group. The effects of group participation are accounted for in the theory by self and interpersonal influence processes. The final problem was that of designing an experimental task and environment which would provide the requisite test data. The experiment used permits both individuals and groups to generate observable sequentially linked behavior. Subject behavior is task dependent. R.N.A.

N67-11965*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.

SOME CHARACTERISTICS OF TECHNICAL ENTREPRENEURS

Edward B. Roberts and Herbert A. Wainer May 1966 32 p refs

(Grants NsG-235; NsG-496)

(NASA-CR-77278; Rept.-195-66) CFSTI: HC $2.00/MF $0.50 CSCL 05J

Sixty-nine technical entrepreneurs were studied emphasizing description of several of their characteristics such as family background, education, and motivation. The results indicate that entrepreneurial fathers are more likely to produce entrepreneurial sons. An individual's home environment and attitudes that seem to be embodied in his religious background are likely to have strong influences on his goal orientation, education, and whether or not he becomes an entrepreneur. In addition, those technical entrepreneurs whose fathers had high occupational status were educated sooner and to a higher level than those whose fathers had low occupational status. At the same time it was determined that the technical entrepreneurs who had self-employed fathers were educated usually to around the Master of Science degree level, the median education of the entire sample. Author

N66-38721*# Washington Univ., St. Louis, Mo. Dept. of Economics.

DEMAND FOR ENGINEERS AND SCIENTISTS

Hugh Folk Sep. 1966 78 p refs *Its* Working Paper No. 6608

(Grant NsG-342)

(NASA-CR-78487) CFSTI: HC $3.00/MF $0.75 CSCL 05I

This study is primarily concerned with engineers, physical scientists, and mathematicians. The demand is analyzed in terms of manpower requirements and economics in the United States. Considered are the growth of research and development spending by industry and government, the changing rates in employment patterns, changes in engineer and chemist ratios, changes in functions of engineers and scientists, and labor market adjustments. Numerous statistical compilations are included. K.W.

N66-35769*# Washington Univ., St. Louis, Mo. Dept. of Economics.

STARTING SALARIES OF ENGINEERS AND SCIENTISTS

Hugh Folk Aug. 1966 28 p refs *Its* Working Paper 6606

(Grant NsG-342)

(NASA-CR-77677) CFSTI: HC $2.00/MF $0.50 CSCL 05C

Changes in starting salaries of engineers and scientists during the postwar period are examined. Discussed are patterns of demand that have affected the market for engineers and scientists since World War II, changes in starting salaries of engineers relative to other occupations, changes within the field of engineering, and changes in the structure of engineers' salaries. S.C.W.

N66-33398* Michigan Univ., Ann Arbor. Inst. for Social Research.

CONTACTS WITH COLLEAGUES AND SCIENTIFIC PERFORMANCE

Frank M. Andrews 1 Jun. 1966 30 p refs Submitted for Publication

(Grant NsG-498)

(NASA-CR-77013) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Contacts between people in laboratory organizations were investigated to determine some environmental factors which might stimulate scientific productivity. To this end, a specially-prepared questionnaire was administered to hundreds of scientists and engineers in 11 diverse American laboratories, and a similar questionnaire was devised for use in three British industrial laboratories. In both questionnaires "colleagues" were defined as other professionals, both subordinate and superior, with whom a scientist worked. In addition to the results from the questionnaires, performance ratings were obtained from both peers and superiors. Among the sociological factors considered, contact with colleagues seemed to be the one which most stimulated technical performance. There appeared to be several different paths to effective interaction, but contact with many people is most important. M.W.R.

N66-32287*# California Univ., Los Angeles. Graduate School of Business Administration.

FUNCTIONAL AMBIGUITY AND THE CUSHIONING OF ORGANIZATIONAL STRESS

Fred Masarik [1965] 19 p ref Sponsored by NASA

(NASA-CR-76698) CFSTI: HC $1.00/MF $0.50 CSCL 05J

The positive aspects of ambiguity and its function in cushioning organizational stress is discussed. A curvilinear function relating ambiguity to organizational effectiveness shows that optimal effectiveness exists at some intermediate point between maximum ambiguity and maximum clarity. It is pointed out that too little ambiguity limits adjustment to change for individuals and organizational subsystems, and too much ambiguity impedes effectiveness by creating anixiety for individuals and by obscuring guidelines for organizational survival. Several case examples of this ambiguity principle in management operations are presented. A.O.

N66-12994# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.

CONTINUITY AND OPENNESS IN HIGH ENERGY PHYSICS GROUPS

Henry B. Eyring Sep. 1965 24 p refs Its Working Paper No. 142-65

(Grant NsG-235)

(NASA-CR-68303) CFSTI: HC $3.00/MF $0.65

Unstructured interviews were conducted with twenty eight individuals in eleven high energy physics groups working in five organizations to explore the effects of organizational affiliation on their collaboration and admission of new members. One structural variable focused upon was whether the groups were composed of members from one organization or from more than one. Findings suggest that group structure and both continuity and openness of the group are related, but further verification is needed (particularly by considering group size and the type of experimental problem as independent variables). L.S.

N66-12989*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.

PROBLEM SOLVING STRATEGIES IN PARALLEL RESEARCH AND DEVELOPMENT PROJECTS

Thomas J. Allen Jun. 1965 27 p refs *Its* Working Paper No. 126-65 Sponsored by NASA

(NASA-CR-68375) CFSTI: HC $2.00/MF $0.50 CSCL 05A

Three pairs of parallel R & D projects are examined. The data analyzed were gathered by means of Solution Development Records—a form which provides a weekly estimate of the probability of adoption of the approaches under consideration as possible solutions to a technical problem. It is found that the longer an approach is indicated by these forms to be in a favored position, the more difficult it is to reject. Furthermore, the number of alternative technical approaches considered bears a relation to judged solution quality. Groups producing higher-rated solutions generated fewer approaches during the course of the project, and they more closely approach an ideal strategy of approaches off on a two-at-a-time basis than do their poorer performing rivals. Author

N65-90287* Massachusetts Inst. of Tech., Cambridge. School of Industrial Management.

NOTES ON CAREER GROWTH IN NASA PATTERNING OF INTERVIEW RESPONSES

David R. Peters Apr. 1963 23 p refs

(Grant NSG 235-62)

(Rept.-17-63)

Reported is an attempt to identify career growth patterns from responses of professional and supervisory personnel at the Langley and Lewis Field Centers to semi-structured interviews. Presented is a descriptive and qualitative synthesis of data consisting of both a partial summary of interview data and a simplified model to be used for heuristic purposes in elaborating the research project. Variables studied focused on: (1) the individual's career development; (2) role stresses in his present position and their resolutions; (3) performance feedback and its effects upon careers; and (4) the individual's perceptions of general career patterns in the Field Center and the organizational variables which influence career structure and development. S.C.W.

N65-90207* Massachusetts Inst. of Tech., Cambridge. School of Industrial Management.

THE ENGINEERING TECHNICIAN: DILEMMAS OF A MARGINAL OCCUPATION

William M. Evan Sep. 1963 33 p refs Submitted for publication

(Grant NsG-235-62)

(MIT-36-63)

The engineering technician occupies a position in the occupational hierarchy intermediate between that of the engineer and that of the craftsman. His ambivalence regarding his status and the ambivalence of others towards him contribute to his marginal position. The marginality of the engineering technician is also reflected in the heterogeneous nature of his work, the multiplicity of titles used to designate his work, his education and training, the rate and method of compensation, his self-image and the public images of his occupation. Various adaptations to the built-in role strains of his occupation are analyzed. The ratio of engineering technicians to engineers is markedly lower in the United States than it is in Great Britain, France, the Soviet Union, and West Germany. The cultural values placed on achievement and the college-centered character of the American educational system contribute to this shortage. The recruitment of women into this occupation may relieve the shortage. Pressures for professionalization of engineering technicians, generated by on-going technological changes, may reduce the marginality of this occupation. Author

N65-30468*# Washington Univ., St. Louis, Mo. Dept. of Economics.

ATTRITION OF GRADUATE ENGINEERS

Hugh Folk 23 Jun. 1965 15 p refs *Its* Working Paper No. 6512

(Grant NsG-342)

(NASA-CR-64114) CFSTI: HC $1.00/MF $0.50 CSCL 05I

Statistical methods are used to estimate the overall attrition rate of graduate engineers for the various engineering specialties. It was assumed that the stock of employed engineers in 1950 grows at a gross compound rate γ and is subject to attrition at a compound rate α over the period 1950–1960. Formulas are calculated from these assumptions. The estimates presented exceed by a considerable amount other similar government estimates. Data are tabulated. L.S.

N65-27953*# Washington Univ., St. Louis, Mo. Dept. of Economics
THE SUPPLY OF ENGINEERS AND SCIENTISTS
Hugh Folk 10 Jun. 1965 61 p refs *Its* Working Paper No. 6506
(Grant NsG-342)
(NASA-CR-27953) CFSTI: HC $3.00/MF $0.75 CSCL 05I

Some of the aspects of the supply of engineers and scientists are discussed and data are presented on enrollments, degrees, earnings, and occupational choices of persons with engineering and science degrees. Among the conclusions of the analysis were the following: (1) Over the period 1950 to 1960, the rate of change of the number of nongraduate engineers in the various specialties is highly correlated with the rate of change of the number of graduate engineers in the same specialties. (2) Men graduating in engineering and science do not all enter engineering or science. The proportion of engineering graduates entering such jobs is much higher than the proportion of men with science degrees. (3) Over one-half of the very able freshmen choosing engineering and science as careers change career anticipations by their senior year. (4) Over the past 30 years there has been little change in the prestige ranking of engineering relative to other occupations commonly entered by college graduates. Engineering starting salaries have increased steadily as a percentage of general business trainees starting salaries, however, for chemists such salaries have declined. E.E.B.

N65-26425*# Massachusetts Inst. of Tech., Cambridge. School of Industrial Management
ENGINEER DYNAMICS AND PRODUCTIVITY IN R AND D PROJECTS Organizational Research Program
Edward B. Roberts Oct. 1963 27 p refs
(Grant NsG-235-62)
(NASA-CR-63405) CFSTI: HC $2.00/MF $0.50 CSCL 05I

The dynamic process of engineer acquisition and utilization in R and D projects is diagrammed and described. Policies for engineer acquisition, training, and transfer are discussed. The bases for engineer productivity are defined and organized into a structural representation that includes effects of technology, experience, management, and organizational factors. Some results of computer simulations of an R and D project model are presented, indicating the sensitivity of project outcomes to various training times, initial staff sizes and other factors affecting productivity. Author

N65-21386*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GOVERNMENT RESEARCH, THE ENGINEER, AND THE PROFESSIONAL SOCIETY
I. E. Garrick [1965] 10 p Presented at the 31st Ann. Meeting, Southeastern Sect., Am. Soc. for Eng. Educ., Richmond, Va., 12–13 Apr. 1965
(NASA-TM-X-56295) CFSTI: HC $1.00/MF $0.50

Various means of providing continued education for scientists and engineers in space science are discussed generally. The need for continuing scientific education for all space science professional personnel is expressed, and the need for participation by private industry, government agencies, and professional societies is stressed. Current methods for promoting ongoing education include working experience for undergraduates, summer seminars at universities, university extension courses and staff seminars at industrial and space science installations, and conferences and periodicals sponsored by professional societies. J.M.D.

N64-23327* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MOTIVATION OF TECHNICAL PERSONNEL
Michael J. Vaccaro N.Y., AIAA [1964] 7 p Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul 1964 (AIAA Paper-64-407) AIAA: $0.50 members, $1.00 nonmembers

This paper is concerned with a human-relations investigation of a group of aerospace research and development general-management and project-management personnel to ascertain the following: (1) which motivational elements served as stimulators and which served as dissatisfiers; and (2) to what extent did the provision by the Government of an incentive contract serve to assist these organizations in establishing the climate for attracting and retaining technical personnel. N.E.A.

M6 URBAN MANAGEMENT

N67-38944* Wayne State Univ., Detroit, Mich. Center for Application of Sciences and Technology.
THE APPLICATION OF AEROSPACE TECHNOLOGY TO URBAN MANAGEMENT
[1966] 95 p refs
(Contract NSR-23-006-034)
(NASA-CR-89307) CSCL 05C

A program was initiated to test the hypothesis that aerospace related science and technology have urban management applications, and can be efficiently utilized by local govenment. Concepts and procedures which appear to be necessary for the efficient design and operation of the program were postulated. Some of the potentials and limitations of applying the aerospace technology to urban management are defined. Specific urban problem areas which appear to be resolvable through the application of aerospace generated technology are identified. L.S.

N67-32557*# California Univ., Berkeley. Space Sciences Lab.
TECHNOLOGY AND URBAN MANAGEMENT Semiannual Report, 1 Oct. 1966–31 Mar. 1967
C. W. Churchman and M. M. Webber 31 Mar. 1967 38 p refs *Its* Space Sci. Lab. Ser. No. 8, Issue No. 28
(Grant NGR-05-003-125)
(NASA-CR-86664) CSCL 05C

Reported is the initiation of a study designed to explore the opportunities that might be latent within the newly emerging technologies. The study was undertaken in an effort to deal with critical problems of the city as: (1) the declining proportion of total employment contributed by manufacturing and unskilled operations and the rise of the service occupations; and (2) the declining opportunities for employment, skills, improvements and acculturation into modern society of rural migrants. Discussed are joint efforts of NASA, the University of California, the city of Oakland, and the Ford Foundation which focus on alleviating these problems created primarily by the inability of contemporary urban society and the city to adapt to changes induced by science and new technological innovations. S.C.W.

N67-31640*# Northwestern Univ., Evanston, Ill. Dept. of Geography.

SPATIAL DATA SYSTEMS: SYSTEMS CONSIDERATIONS

Kenneth J. Dueker Dec. 1966 78 p refs

(Grant NGR-14-007-027; Contract Nonr-1228(37))

(NASA-CR-85827; TR-5) CSCL 05B

The greater speeds and storage capacities of newer computers requires new concepts of data organization and new means to create and access these more complex data structures. Of particular concern in urban and transportation planning are needs to link separately collected data that relate to the same phenomena or spatial locations, and a need for user-oriented data handling capabilities. These needs are explored and recommendations are made. This volume deals with entity linkage, organization of data for retrieval, search efficiencies, point in polygon procedures and retrieval from digitized imagery. Author

N67-31145*# Northwestern Univ., Evanston, Ill. Dept. of Geography.

SPATIAL DATA SYSTEMS: ORGANIZATION OF SPATIAL DATA

Kenneth J. Dueker Dec. 1966 63 p refs Partially sponsored by NASA

(Contract Nonr-1228(37))

(NASA-CR-85616; TR-4) CSCL 05B

A limited explication of current needs for classifying and organizing spatial data for use in urban and transportation planning is presented. In addition to a discussion of terms associated with spatial data, the requirements and methods for handling the data are explored with a view toward utilization of data acquired from remote sensors mounted on earth orbital platforms. The work provides a basis for examination of some problems of integrating remote sensors into a viable geographic information system. Covered are also hardware–software configurations, search and retrieval efficiency, point in polygon procedures, and retrieval from digitized imagery. K.W.

N66-31894*# General Electric Co., Santa Barbara, Calif. TEMPO Div.

APPLICATION OF AEROSPACE TECHNOLOGIES TO URBAN COMMUNITY PROBLEMS

M. L. Feldman, L. A. Gonzalez, and A. B. Nadel 23 Sep. 1965 185 p refs

(NASA Order R-5177)

(NASA-CR-76524; RM-65TMP-53) CFSTI: HC $3.25/MF $1.25 CSCL 05K

This study was conducted to clarify the manner in which NASA-developed technology can be used to help existing cities improve their physical, social, and economic environments by resolving some of the more immediate and critical problems in these environments and to aid in planning and developing new urban communities. An evaluative matrix is shown which relates the major ecological categories and subcategories of critical city problems to the major NASA technological categories. The matrix summarizes and classifies the critical city problems identified and discussed in this report and presents the problems in a framework of opportunities for applying technological solutions using NASA-developed technologies. The critical city problems are identified through discussions of the background, nature, and impact of each problem. The study shows that NASA can contribute to the solution of urban community problems through the application and transfer of its technologies. The appendices discuss the application of systems analysis to the municipal police system and waste management, a methodology for hospital and medical facilities planning, and the concept of enclosed communities. R.N.A.

N65-88165* Washington Univ., St. Louis, Mo. School of Law.

THE CANADIAN AND AMERICAN NEW TOWN PROGRAMS

John R. Mc Farland May 1965 54 p refs

(Grant NSG-342)

(NASA-CR-64846)

Discussed are two programs of new town planning and construction: the first is one that was adopted in Alberta, Canada, the second is the New Deal greenbelt cities program of the United States. The Alberta program represents the most advanced program of the Canadian Provinces, relies more on private industry than on government involvement, and is designed chiefly for developing small rural towns in large unsettled regions. The greenbelt program of the New Deal is the only example of a federally-sponsored new towns program in the United States; it is representative of a program with a high degree of government involvement, and the resulting communities are of the dormitory suburb type. The two programs are to illustrate problems which must be faced in developing a national program for new town construction in the United States. K.W.

N65-30479*# Washington Univ., St. Louis, Mo. Dept. of Economics.

AN ANALYSIS OF REGRESSION ESTIMATORS FOR URBAN EMPLOYMENT MULTIPLIERS AND THEIR APPLICATION TO THE EMPLOYMENT IMPACT OF THE AEROSPACE INDUSTRY IN THE ST. LOUIS STANDARD METROPOLITAN STATISTICAL AREA

Se-Hark Park (Ph.D. Thesis) Jun. 1965 118 p refs

(Grant NsG-342)

(NASA-CR-64088) CFSTI: HC $4.00/MF $0.75 CSCL 05C

A study is presented that analyzes through multiple regression estimation methods, the multiplier effects on the local employment in the St. Louis Standard Metropolitan Statistical Area resulting from monthly variations in investment and in the aerospace and other major export activities from January, 1958, to June, 1964. The study is presented in six chapters. Chapter II deals with export employment estimates. The model for urban employment multipliers is developed in Chapter III. Chapter IV pertains to a statistical estimation of the model for urban employment multipliers developed in Chapter III. Chapter IV is devoted to a study of the use of error formulas with time series. In Chapter V, the study utilizes multipliers obtained in an examination of the impact of a given employment change in the aerospace industry on the St. Louis area economy in terms of direct and indirect increases in the area employment. The results are summarized in Chapter VI. N.E.A.

N65-27051*# Washington Univ., St. Louis, Mo. Dept. of Economics.

FEDERAL RESOURCES AND URBAN NEEDS

Murray L. Weidenbaum [1965] 41 p refs Presented at Washington Univ. Conf. on Planning for the Quality of Urban Life *Its* Working Paper 6507

(Grant NsG-342)

(NASA-CR-63517) CFSTI: HC $2.00/MF $0.50 CSCL 05C

Future implications of the changing patterns of defense and space expenditures are analyzed. Possibilities for transferring potentially available financial and physical resources from Federal programs to state and local governments are explored. Extrapolations are made for estimating future revenues and expenditures, and gross national product. L.S.

N64-11502#* National Aeronautics and Space Administration, Washington, D. C.

CONFERENCE ON SPACE, SCIENCE, AND URBAN LIFE

W. E. Thompson 1963 265 p refs Conf. held at Oakland, Calif., 28–30 Mar. 1963; Supported by NASA, Ford Found., and City of Oakland, Calif.
(NASA-SP-37)

Applications of space research to the problem of a city and its business and industrial community are explored. Implications of the space effort for science and technology are discussed; and some insight into the scope of the National Space Exploration Program is attempted. Goals and potentials of space scientific research; economic, political, and sociological implications; and the effects of developments in the areas of transportation, communication, power resources, construction industries, manpower needs, and public health and sanitation are some of the problems discussed. L.S.

M7 MANAGEMENT POLICY & PHILOSOPHY

N67-32361* Chicago Univ., Ill.
SOME DETERMINANTS OF ORGANIZATIONAL SUCCESS
Frank Stafford (Mich. Univ.) and Selwyn W. Becker [1967] 15 p refs
(Grant NsG-370)
(NASA-CR-86985) CFSTI: $3.00 CSCL 05K

Measurements of the relative effect on organization efficiency of variables frequently utilized by psychologists, economists, and sociologists are made. To what extent variance in organizational efficiency can be explained by organization size, adoption of innovations, psychological distance in the management team, administrative size, and the state of the organization's surrounding environment is investigated. Author

N67-18252*# Chicago Univ., Ill. Graduate School of Business.
AN ENTREPRENEURIAL THEORY OF FORMAL ORGANIZATIONS. PART I: PATTERNS OF FORMAL ORGANIZATIONS
Selwyn W. Becker and Gerald Gordon [1966] 53 p refs
(Grant NsG-370)
(NASA-CR-71866) CFSTI: HC $3.00/MF $0.65 CSCL 05J

A theory of formal organizations is presented which includes, as a first step, the development of a taxonomy which allows an ordering of relevant data. This taxonomy is based on two variables, the nature of organizational procedures and the nature of the organization's resources. Classifying organizations by these two variables yields information about bureaucratic structures and about the manner in which authority is exercised in these structures. Further, use of the taxonomy allows inferences to be made about the environmental conditions associated with the emergence of the various bureaucratic structures. A formal organization is defined to be a purposely developed system, i.e., an ongoing interaction of procedures and resources to which an owner has property rights. It is assumed that the reason an owner seeks to attain his goal by creating (using, buying, renting, etc.) an organization is to obtain the economic or psychological advantages that result from coordination. C.T.C.

N67-18199*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PROBLEM OF THE AGED SCIENTIFIC ORGANIZATION
E. R. Harrison 30 Nov. 1965 6 p Submitted for Publication
(NASA-TM-X-57084) CFSTI: HC $3.00/MF $0.65 CSCL 05J

The problem of the aged scientific organization, with its misinterpretation of the scientific spirit, its misdirection of scientific effort, and the attendant misuse of money is considered, and practical methods to tackle this problem are suggested. Emphasis is placed on the fact that a scientific organization can only endure and exist in a healthy state when its staff at all levels are engaged in making manifest the following factors: learning, the advancement of knowledge, teaching, and the application of ideas. A.G.O.

N67-17879*# Chicago Univ., Ill. Graduate School of Business.
SOME DETERMINANTS OF ORGANIZATIONAL SUCCESS
Frank Stafford and Selwyn W. Becker [1965] 19 p refs Submitted for Publication
(Grant NsG-370)
(NASA-CR-70451) CFSTI: HC $3.00/MF $0.65 CSCL 05J

Attempts are made to measure the relative effect on organization efficiency of variables frequently associated with the disciplines of psychology, economics, and sociology. The purpose is to determine how much of the variance in organizational productivity can be explained by organization size, adoption of innovation, psychological distance in the management team, and environmental state. To measure psychological distance in the management team and the adoption of innovations the chief executives of over a hundred savings and loan associations were asked to fill out questionnaries. The dependent variable investigated was organization success, efficiency, or productivity. The different independent variables used were organization size, growth rate of the surrounding community, adoption of innovations, past profitability and psychological distance in the management team. S.P.

N67-12626*# National Aeronautics and Space Administration, Washington, D. C.
TECHNICAL PROGRESS AND OBSOLESCENCE [PROGRES TECHNIQUE, FISCALITE, OBSOLESCENCE]
C. Sarthou et al Apr. 1966 146 p refs Transl. into ENGLISH from Cahier d'Etudes of the Groupe d'Etudes, Recherche et Developpement de l'Association Francaise Pour l'Accroissement de la Productivite (France), no. 2, 1964
(NASA-TT-F-10467) CFSTI: HC $4.00/MF $1.00 CSCL 05C

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1. TECHNICAL PROGRESS, FISCAL AFFAIRS, OBSOLESCENCE C. Sarthou et al p 1–41 refs (See N67-12627 03-34)
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3. SPECIAL DISPOSITIONS FOR RESEARCH ACTIVITIES BY BUSINESS ENTERPRISES p 51–71 (See N67-12629 03-34)
4. POTENTIALITIES AND DANGERS OF TECHNOLOGICAL EVOLUTION J. R. Bright p 72–101 (See N67-12630 03-34)
5. RESEARCH, DEVELOPMENT, AND GROWTH G. W. Wilson p 102–109 refs (See N67-12631 03-34)
6. REPLY TO G. W. WILSON R. Solo p 110–116 ref (See N67-12632 03-34)
7. ANALYSIS OF THE "ROLE AND EFFECT OF TECHNOLOGY ON THE NATIONAL ECONOMY" OF THE UNITED STATES J. C. Arinal p 117–137 refs (See N67-12633 03-34)

N66-37640*# California Univ., Berkeley. Space Sciences Lab.
THE DICHOTOMIES OF ENGINEERING DESIGN
Ian I. Mitroff Aug. 1966 23 p refs *Its* Internal Working Paper No. 51
(Grant NsG-243-62)
(NASA-CR-78381) CFSTI: HC $1.00/MF $0.50 CSCL 05E

The decision rules which an engineer uses in design have been computerized in an effort to analyze the engineering design

process. It was found that several traditional distinctions must be reexamined, since they can be shown to break down; this applies especially to design optimizations that strictly separate between the abstract and the concrete aspects and thus prevent an attempt to describe engineering as a social process. It was found quite impossible to program the job of a single engineer without in turn programming the co-producer's and the user's of the design. G.G.

N66-28565*# National Aeronautics and Space Administration, Washington, D. C.
THE ACHIEVEMENT OF SPACE: VALUES AND DIRECTIONS
Robert C. Seamans, Jr. 15 Mar. 1966 31 p 1st Ann. Dr. Robert H. Goddard Lecture of the Natl. Space Club
(NASA-TM-X-57527) CFSTI: HC $2.00/MF $0.50 CSCL 05A

The pivotal concept that has guided NASA administration is defined by Dr. Robert C. Seamans, Jr., NASA Deputy Administrator, as the relation of the research and development project ot the many rapidly growing disciplines of science and technology. Project planning is discussed from this context, and the interrelationships of manpower requirements, the scheduled advances from concept, to design, to test, and actual operation; and program management are delineated. It is emphasized that a project team must operate within the agency's across-the-board management structure; that detailed regulations control the procurement cycle; that resource requirement estimates must be developed according to agency operating plan and budget procedures; and that status reports must be prepared in standard formats. Six representative project problems are cited as representative examples of the kind of experience from which useful management generalizations can be drawn. The involvement of the university–industry–government team in the research and development effort is stressed, and the potential applications of space achievements to nonspace use is discussed. M.G.J.

N65-85149* National Aeronautics and Space Administration, Washington, D. C.
THE ECONOMIC IMPACT OF THE SPACE PROGRAM
James E. Webb Reprinted from Business Horizons, Fall 1963. 11 p

Presented is a discussion of the long range impact of the space program on the nation's economy and on the American business community. Focused on are several of the possible effects of the space program on business, on the economic growth of states or regions, and on the economic life of the nation. Economic benefits of the following are considered: (1) NASA's subcontracting system and the distribution of funds; (2) weather and communication satellite technology and development; (3) new programs such as NASA's Technology Utilization Program; (4) new management skills and techniques which are being generated as a direct result of space research programs; (5) automation and increased demands for highly trained manpower to meet national needs; (6) effective utilization of the incentive contract; and (7) NASA studies of life in closed ecological systems (spacecraft) and the applicability of results to urban problems. S.C.W.

N65-83167* George Washington Univ., Washington, D. C.
NUCLEAR TECHNOLOGY AND THE FABRIC OF GOVERNMENT. PROGRAM OF POLICY STUDIES IN SCIENCE AND TECHNOLOGY, PAPER NO. 7
Harold P. Green Repr. from George Washington Law Rev., No. 1, Oct. 1964 refs Jan. 1965 45 p refs
(Grant NSG-727)
(NASA-CR-57554)

Impact of the atomic energy program on the fabric of government is discussed in terms of government organization, policy making, government-industry relationships, and the role of specialists. It is noted that government and legal mechanisms have accommodated to the demands of a mushrooming technology, but that in all likelihood the innovations and techniques developed by the atomic energy government establishment will not be adapted to analogous areas. As nuclear energy becomes more practical for various peaceful uses, the government-industry relationship will probably change and the role of the AEC and the JCAE will lessen. Aspects of policy making that are discussed include subsidization, indemnification, and state jurisdiction. M.W.R.

N65-30483*# George Washington Univ., Washington, D. C.
THE MANAGEMENT OF SCIENCE
Apr. 1965 42 p refs *Its* Paper No. 8
(Grant NsG-727)
(NASA-CR-64149) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Leadership and administration in science and technology are considered in two articles. Sponsorship of individual researchers, the relationship of industrial research and development to management, leadership provided by universities and foundations, and the impact of federal agencies are discussed in the first article; and the leadership role of scientists and technologists in national goal setting is stressed. Means of developing leadership and various organizational concepts are treated. Science administration is considered a contradictary idea because it limits the scientist in performing his research. The role of the science administrator is, therefore, considered to be that of creating an environment to nourish scientific creativity. M.W.R.

N64-11113* National Aeronautics and Space Administration, Washington, D.C.
ADMINISTRATION AND THE CONQUEST OF SPACE-News Release
James E. Webb [1962] 12 p Presented at the Natl. Conf. of Am. Soc. for Public Admin., Detroit, 13 Apr. 1962

James E. Webb, administrator of the National Aeronautics and Space Administration, in a speech on "Administration and the Conquest of Space" discussed five characteristics which distinguish NASA's assignment. He stated that: (1) space research and exploration has multiple and interrelated objectives; (2) space research and exploration requires a wide variety of skills and a vast accumulation of facilities and equipment; (3) long lead times, coupled with a rapidly evolving technology, adds further complexities to the task of organization of human effort for space exploration; (4) a high order of reliability is an absolute necessity; and (5) space research and exploration must be carried on under the persistent and exacting scrutiny of the public, the Congress, and the scientific community. P.V.E.

M8 ECONOMICS

N67-37784* Washington Univ., St. Louis, Mo.
[ANALYSES OF THE IMPACT OF SPACE ACTIVITIES ON THE NATIONAL ECONOMY, AND ESTABLISHMENT OF A METHODOLOGY FOR DETERMINING SPACE PROGRAM EFFECTS ON REGIONAL ECONOMIC GROWTH] Progress Report, 15 Mar.–15 Sep. 1967
Murray L. Weidenbaum 15 Sep. 1967 151 p refs
(Grants NsG-342; NSF G-22296)
(NASA-CR-88486; PR-8) CSCL 05A

Based on an analysis of NASA 1st and 2nd tier subcontract activities, a forecasting model is designed to provide first approximations of the geographic distribution of subcontract awards.

In one approach, multiple regression equations were developed based on each state's share of the subcontract awards (dependent variable), and its corresponding share of total United States technical personnel and key industry employment (independent variables). A regional approach was considered based on differences in technical and industrial emphasis of subcontract procurement resulting from different prime activities. By categorizing prime contracts on the basis of their contract activities, fairly stable 1st tier subcontract distribution patterns on the Northeast, Pacific, and East North Central regions are developed. It is concluded that the 1st and 2nd tier subcontract programs provide a wider and less concentrated distribution of NASA dollars, particularly at the state level. However, the extent of the redistribution, as reflected by the total net distribution of prime awards, is only of marginal significance at the more aggregate regional level. M.G.J.

N67-37249*# Washington Univ., St. Louis, Mo.
THE MILITARY/SPACE MARKET: THE INTERSECTION OF THE PUBLIC AND PRIVATE SECTORS
Murray L. Weidenbaum Sep. 1967 79 p refs Working Paper 6712
(Grant NsG-342)
(NASA-CR-88699) CSCL 05A

The nature of the military and space market in the United States; the customers; the sellers; price formation and competition; specialized contractors; and the changing nature of the contractors, are discussed. L.S.

N67-28780*# California Univ., Berkeley. Space Sciences Lab.
THE BASIS OF SCIENTIFIC CHOICE OR ON CRITERIA FOR PUBLIC SUPPORT OF SCIENCE AND TECHNOLOGY
D. J. Montgomery Mar. 1967 46 p refs *Its* Internal Working Paper 48
(Grant NsG-243)
(NASA-CR-84798) CSCL 05A

A scheme for rational allocation of public resources for the support of science and technology is proposed. It aims to supplement and rationalize the body of technical information on which decisions are in part based. The scheme goes out from the explicit recognition that any governmental activity is undertaken for its contribution to a multiplicity of common goals. It then requires any proposed activity to be evaluated with respect to the potential contribution to each of the common goals. The guiding principle in setting up the evaluation procedures is to seek commensurable alternatives between which choices are to be made. The results of the evaluation process are submitted to the government officials who are responsible for decision, as an input that they are to take into account in arriving at the allocation of government resources. The scheme can be generalized to aid in establishing priorities among programs within specific scientific-technological missions as well as to aid in allocating government resources among broad national goals. Author

N67-19956*# Washington Univ., St. Louis, Mo. Dept. of Economics.
THE ROLE OF ECONOMICS IN LONG-RANGE PLANNING FOR AN AEROSPACE COMPANY
Murray L. Weidenbaum Jan. 1967 38 p refs *Its* Working Paper No. 6701
(Grant NsG-342)
(NASA-CR-82943) CFSTI: HC $3.00/MF $0.65 CSCL 05A

The discussion focuses on the applications of economic analysis in private corporations, notably those in the aerospace industry. Emphasis is placed on business management because that aspect of company activity provides an excellant framework for surveying the various potential applications of economic theory, methodology, and statistics to the business firm. Five phases of the business planning process are treated to indicate the actual and possible influence of economic factors and contributions of economic analysis of each of them. These include: 1) setting forth the external environment in which the business enterprise will be operating during the planning period, 2) establishing long term goals and objectives for the enterprise, 3) formulating the key programs and major undertakings on which the company will embark, 4) analyzing the capability of and resources available to the enterprise, and 5) evaluating the adequacy of the developmental programs to meet the goals and objectives in the anticipated environment. Finally, the role of the business economist is defined. R.N.A.

N67-12264*# Washington Univ., St. Louis, Mo. Dept. of Economics.
THE FEDERAL BUDGET AND THE OUTLOOK FOR DEFENSE SPENDING
Murray L. Weidenbaum Nov. 1966 23 p refs *Its* Working Paper No. 6610
(Grant NsG-342)
(NASA-CR-80116) CFSTI: HC $1.00/MF $0.50 CSCL 05A

The current economic impact of the Viet Nam military buildup on the economy as a whole and on the Federal budget are examined, and defense spending is projected for 1967. The past spending as a result of the Viet Nam commitment is reviewed, and differences from the Korean situation are pointed out. The shifts taking place in military spending are identified. It is concluded that the major portion of the impact on the economy of the current defense buildup has already been felt. It is expected that the inflationary pressures accompanying the expansion in defense spending may subside during the coming year and that expansion of nondefense spending may take place. N.E.N.

N67-11841*# Washington Univ., St. Louis, Mo. Dept. of Economics.
FEDERAL NON-DEFENSE EXPENDITURES: THEIR SHIFTING IMPACT ON THE REGIONAL DISTRIBUTION OF INCOME
Gerald W. Williams Nov. 1966 32 p refs *Its* Working Paper 6609
(Grant NsG-342)
(NASA-CR-79997) CFSTI: HC $2.00/MF $0.50 CSCL 05C

The purposes of this study are: (1) to identify the redistributional impact on regional income of certain Federal public welfare and economic development expenditure programs; and (2) to analyze this impact for selected years in the period 1948-1963. Tabulated data of the various programs are presented, and two hypotheses are analyzed, namely (1) that development programs at any point in time are progressive and hence equalize regional income; and (2) that development programs, welfare programs, and the combination of the two, equalize regional income over time. Although no conscious effort by the Federal government to redistribute regional income is apparent, it is pointed out that the effects of expenditure programs must be taken into account when Federal spending is decided. K.W.

N66-81242* Washington Univ., St. Louis, Mo.
SHIFTING THE COMPOSITION OF GOVERNMENT SPENDING: IMPLICATIONS FOR THE REGIONAL DISTRIBUTION OF INCOME
Murray L. Weidenbaum [1965] 49 p refs Presented at Ann. Meeting of Regional Sci. Assoc., Philadelphia, 14 Nov. 1965
(NSG-342)
(NASA-CR-69555)

Typical programs within each major category of federal expenditure are selected, and their patterns of regional distribu-

tion among each other and with that for population and personal income in the United States are compared. The economic impact of the regional distribution of federal funds is assessed, and it is shown that the expansion in the Great Society and other domestic civilian programs is resulting in a shift in the geographic distribution of federal expenditures. The view is offered that this shift should work towards a change in regional income distribution and, in a very specific way, toward greater income equality. A hypothetical analysis is presented to show the comparatively mild effects of a 50% reduction in defense spending and an offsetting aggregate increase in federal nondefense expenditures. M.G.J.

N66-37542*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

THE R & D FACTOR IN INTERNATIONAL TRADE AND INTERNATIONAL INVESTMENT OF UNITED STATES INDUSTRIES

William Gruber, Dileep Mehta, and Raymond Vernon Jun. 1966 46 p refs

(Grant NsG-496)

(NASA-CR-78382; CSR-TR-66-8) CSFTI: HC $2.00/MF $0.50 CSCL 05C

The functioning of research and development in the creation of new products, new processes, and new systems that lead to industrial concentrations and large scale operations of United States industries in the framework of international trade are studied. International economic investments constitute a certain hold on export positions through their subsidiarized sales force; but neither exports nor overseas investment have much prominence when normalized by the level of activities of the same industries in the United States. G.G.

N66-37516*# Midwest Research Inst., Kansas City, Mo.

AN ANALYSIS OF THE IMPACT OF FEDERAL EXPENDITURES ON SELECTED SUB-STATE REGIONS Final Report, 1 Jan. 1962–31 Jul. 1966

Darwin W. Daicoff et al [1966] 47 p refs

(Contract NASr-63(04); MRI Proj. 2571-M)

(NASA-CR-78395) CFSTI: HC $2.00/MF $0.50 CSCL 05C

Procedures for determining the impact of the aerospace program on the economy of substate regions were investigated. The annual estimates of county income for a six-state midwestern region from 1950 to 1962 provided the basis for the regional impact analysis. It was found that it was possible to formulate a model, resting upon the ability to differentiate between exogenous and endogenous income, which could be tested using available data. Statistical methods were applied, and it was determined that rather consistent estimates of the impact of changes in the level of exogenous income on the level of total income could be derived for 9 of the 11 selected areas. Data were developed which measure defense procurement, military wages and salaries, and civilian wages and salaries. An analysis of the impact of changes in the level of defense spending in each metropolitan area showed that the relative contribution of defense spending to income growth varied widely. It was felt that the most important conclusion is that a local impact model can be developed. N.E.N.

N66-36079*# Washington Univ., St. Louis, Mo. Dept. of Economics.

FEDERAL GOVERNMENT BUDGET TRENDS, 1965–1975

Murray L. Weidenbaum Aug. 1966 72 p refs *Its* Working Paper 6605

(Grant NsG-342)

(NASA-CR-77751) CFSTI: HC $5.00/MF $0.75 CSCL 05C

The prospective emerging developments in Federal Government finance during the 1965–1975 time period are analyzed. The emphasis is on estimating the budget results that are likely to occur, with particular attention to the future effects of existing statutory authorizations and commitments. Estimates of each category of Federal cash receipts were made on the basis of projecting their historical relationships to the gross national product or the relevant derivative series. Federal expenditure projections are included for national defense, international affairs and finance, space research and technology, agriculture, natural resources, commerce and transportation, housing and community development, health, labor, and welfare, education, and veterans benefits. The results of the analysis illuminate the availability of funds for space and other national programs and the types of financial pressures which may influence the allocation of public funds to space and other Federal Government programs. A.G.O.

N66-24942*# Washington Univ., St. Louis, Mo. Dept. of Economics.

EMPIRICAL EVIDENCE ON THE GEOGRAPHIC AND INDUSTRIAL DISTRIBUTION OF AEROSPACE EXPENDITURES

Robert A. Bohm Apr. 1966 60 p refs *Its* Working Paper no. 6528

(Grant NsG-342)

(NASA-CR-74770) CFSTI: HC $3.00/MF $0.50 CSCL 05C

The location subcontracting pattern and the interindustry requirements of the Gemini project are surveyed, as the basis for predictive hypotheses on the industrial and regional impact of subcontract expenditures. The data represent actual payments or expenditures to first tier subcontractors, with each subcontractor classified by state and industry. Input–output analytical techniques were used to organize the data and describe the Gemini program's interindustry impact. A state-by-state percentage distribution of the Gemini production function is presented, with the data indicating a definite pattern of subcontract location. These show that Gemini subcontracts are concentrated in a small number of industries, with electronics, instruments, and aircraft predominating. Subcontracts are also highly concentrated geographically, with California and Florida receiving a major portion. Details are given on the construction of an analytic model in which locational factors are used as the basis for predicting geographic interindustry impact for aerospace projects similar to Gemini. M.G.J.

N66-20868*# Washington Univ., St. Louis, Mo. Dept. of Economics.

FEDERAL FINANCING OF RESEARCH AND DEVELOPMENT AND THE REGIONAL DISTRIBUTION OF INCOME

Murray L. Weidenbaum Jan. 1966 12 p refs

(Contract NsG-342)

(NASA-CR-71150) CFSTI: HC $1.00/MF $0.50 CSCL 05C

The extent to which the Department of Defense, the National Aeronautics and Space Agency, and the National Science Foundation act as regional income equalizers was studied. Eight income regions were established by computing regional income data for the continental United States. Overall results indicated that none of the major R & D programs served as regional income equalizers. Ranking of the three programs by computing their Gini coefficients, which are measures of relative equality, showed that Defense Department R & D contracts had the greatest tendency to widen per capita regional income variations; NASA occupied the middle position, while the NSF distribution approximated more closely the composite share of population and income. G.G.

N66-11688*# Washington Univ., St. Louis, Mo. Dept. of Economics.

DEFENSE SPACE EXPENDITURES AND THE DOMESTIC ECONOMY

Murray L. Weidenbaum Sep. 1965 39 p refs *Its* Working Paper 6515

(Grant NsG-342)

(NASA-CR-67976) CFSTI: HC $2.00/MF $0.50 CSCL 05F

Some statistical perspectives are presented to help in understanding the nature of the role that defense and space programs play in the national economy. Because of the economic resources devoted to these two programs, they affect the economy of the nation in several important ways. The following is a sampling of these impacts: (1) These programs utilize a major share of the scientific and engineering talent. (2) The great bulk of all the goods and services purchased by the Federal Government are for the defense and space programs. (3) Because of the specialized nature of the purchases, a relatively few durable goods industries provide most of these needs. (4) The expansion of defense and space programs also signifies that an increasing share of the national economy is independent of the level of private consumption and investment. Budgetary implications, the industrial base, regional impacts, long-term effects, and economic restraints are discussed. E.E.B.

N65-85560* Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering.

AN ANALYSIS OF ALTERNATIVE STRATEGIES FOR ORGANIZING THE APPLIED RESEARCH ACTIVITIES OF DEVELOPING COUNTRIES

A. H. Rubenstein and E. Young [1964] 26 p refs Reprinted

(Grant NsG-495)

(NASA-CR-63274)

Analyses and comparisons are presented of the various "strategies" that have been used or porposed to build up the applied research capabilities of developing countries. A generalized flow model is presented of some of the principal factors having a strong influence on the pattern of applied research. The main factors involved include: the national goals of the country, the economic development pattern, the resources it has available and the constraints under which it operates, the applied research objectives, the resources for applied research, the research capability, the results of applied research, and inevitable other factors which influence the process. Extended discussions are given for a number of these strategies, and a series of illustrative case studies is included. C.T.C.

N65-33500*# Washington Univ., St. Louis, Mo.

MEASURES OF THE IMPACT OF DEFENSE AND SPACE PROGRAMS

Murray L. Weidenbaum 27 Aug. 1965 35 p refs Presented at Ann. Meeting of the Am. Statist. Assn., Philadelphia, 9 Sep. 1965

(Grant NsG-342)

(NASA-CR-64837) CFSTI: HC $2.00/MF $0.50 CSCL 05C

Three aspects of the problem of gaps in statistical information on the economic impact of defense and space expenditures are discussed and include the current stock of information, the increment that will soon become available, and the high priority gaps that need to be filled. Findings from available data show that about one-tenth of the Nation's resources are being devoted to national security programs. Many of these resources are located in a relatively few industries and regions. The industries are predominantly the high technology ones: aircraft, electronics, and supporting firms in such fields as ordnance and instruments. The regions most heavily involved are predominantly areas where these industries tend to cluster, the West Coast and the highly industrialized states of the Northeast. The bulk of the population, area, and industry of the country is only marginally affected by defense and space programs. Only a few companies in a few regions are greatly benefitted or adversely affected by these programs. R.N.A.

N65-28870*# Washington Univ., St. Louis, Mo. Dept. of Economics.

AN EXPLORATORY ANALYSIS OF DEFENSE/SPACE COMPANIES

Murray L. Weidenbaum Jun. 1965 16 p refs *Its* Working Paper No. 6513

(Grant NsG-342)

(NASA-CR-63872) CFSTI: HC $3.00/MF $0.65

An examination of the impact of the government's role in its relationships with the private economy are explored. Statistical data showing the extent to which 35 companies receiving the largest amounts of orders from the Department of Defense and NASA are dependent on such governmental contracts are used as a starting point, and questions of public policy are considered. Comparisons are made for six firms of roughly equal size which cater primarily to the private economy, and to six of the 35 aerospace companies, having corresponding sales. Significant and measurable differences are found in the basic characteristics of the two groups. Some of the differences are in the field of product development decisions, price determination, profit rates, provision of working capital, and research and development funds, source of plant and equipment, nature of the work force, and renumeration of top management. L.S.

N65-27389*# Washington Univ., St. Louis, Mo. Dept. of Economics.

EMPLOYMENT IMPACTS OF DEFENSE EXPENDITURES AND OBLIGATIONS

Edward Greenberg 29 Apr. 1965 28 p refs *Its* Working Paper No. 6505

(Grant NsG-342)

(NASA-CR-63613) CFSTI: HC $2.00/MF $0.50 CSCL 15C

The importance of accurately specifying the impacts of military procurement in models of the economy is discussed. One of the potentially most important applications of such models is to generate the responses of the economy to changes in procurement activity and to evaluate the effects of alternative courses of government action designed to reduce the economic hardships associated with large and rapid changes in military procurement. Based on the description of the government spending process and the regressions for the aerospace industry, the important role played by the obligations variables is demonstrated. Evidence is presented to indicate that two proxies for announcement effects—budget and unobligated appropriations—have substantial impacts on employment. E.E.B.

N63-17458* National Aeronautics and Space Administration, Washington, D.C.

ADDRESS [NASA'S RELATIONS WITH INDUSTRY] News Release

Walter L. Lingle, Jr. May 1, 1963 13 p Presented before the National Capitol Section of the Am. Inst. of Aeronautics and Astronautics

Available from NASA. Office of Scientific and Technical Information, Wash., D.C.

The National Aeronautics and Space Administration's relation with industry is reviewed with emphasis directed to the Agency's procurement policies, how these policies are communicated to industry, and procedures for putting these policies into effect. N.E.A.

M9 GENERAL

N67-81097* GW U., Wash. Dept. of Economics.
AN EVALUATION OF THE PATENT POLICIES OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, GPO, 1966 94 p refs Prepared for NASA
(NSG-425)

Consideration is given to the commercial use and potential of inventions from government financed research, the methods of disclosing these inventions, the utilization of NASA-owned inventions, and results and operation of the waiver policy. Emphasis is placed on discussing the public interest in the disposition of rights to inventions, and on how NASA's patent policies can serve the public in the following areas: (1) advancement of technology, (2) promotion of the agency's mission, and (3) the contribution to other goals of the Federal Government. Appendices are included which discuss disclosures from contractors; petitions for waivers and actions; questionnaires and covering letters; and responses of inventors, licensees, and holders of waivers. C.T.C.

N67-31488*# California Univ., Berkeley. Space Sciences Lab.
NASA: THE SCIENTIFIC IMAGE
L. Vaughn Blankenship Apr. 1967 88 p refs *Its* Paper No. 65
(Grant NsG-243)
(NASA-CR-85799) CFSTI: HC $3.00/MF $0.65 CSCL 05A

To inquire into the responses of the scientific community to the space program and into the image which it has of NASA, a structured, self-administered questionnaire was mailed to a sample of respondents drawn from several different groups of scientists. The subject matter covered was based on some hypotheses about decision-making in science, and the effects of big science on research organization. The major findings reported include: (1) The scientific relevance of the space program is greater for fields like astronomy, atmospheric-earth sciences, physics, and engineering; it is lowest for microbiology, genetics, physiology, chemistry, and mathematics. (2) A considerable discrepancy exists between what scientists believe NASA is, in terms of the goals it has been pursuing, and what it ought to be. (3) Dissatisfaction with NASA as a research-oriented organization stems primarily from a scientist's feelings that the scientific community ought to have a great deal more influence on NASA's programs. M.G.J.

N67-31477*# Denver Research Inst., Colo.
THE CHANNELS OF TECHNOLOGY ACQUISITION IN COMMERCIAL FIRMS, AND THE NASA DISSEMINATION PROGRAM
John S. Gilmore, William S. Gould, Theodore D. Browne, Carl von E. Bickert, Dean C. Coddington et al Washington, NASA, Jun. 1967 146 p refs
(Contract NSR-06-004-039)
(NASA-CR-790) CFSTI: $3.00 CSCL 05A

This report concerns the technological information acquisition behavior and practices of research, development, and engineering personnel in four categories of manufacturing industry: batteries; printing machinery and reproduction equipment; industrial controls; and medical electronics. Also described is one category of service; vocational–technical edcuation, both public and private. From this perspective, the details of research results are reported. These are largely empirical data gathered by interviews and questionnaires, and they classify technology-acquiring personnel and identify the communication channels they use. The major institutions involved in technology transfer such as government, industry, and universities are identified. Their roles relative to information generated in this research are discussed and suggestions are made for additional technology transfer activites by each. Included is a description of NASA's technological information dissemination activities, and a subjective evaluation of these activities; and a description of the industries studied. Research methodology is outlined and supplementary data on research results are discussed. S.C.W.

N67-31342*# Wayne State Univ., Detroit, Mich. Center for Application of Sciences and Technology.
MANAGEMENT TECHNIQUES—A BIBLIOGRAPHY
Victor A. Gajda and Earl E. Borseth, comp. [1967] 194 p refs
(Contract NASr-175)
(NASA-CR-85828) CSCL 05A

The bibliography with abstracts is presented as a part of the program to aid in the transfer of aerospace-related science and technology compiled by NASA. The abstracts have been compiled from *Scientific and Technical Aerospace Reports and International Aerospace Abstracts* through December 1966. Included is the keyword out-of-context index, also compiled from the *STAR* and *IAA* publications. N.E.N.

N67-28770*# Washington Univ., St. Louis, Mo. Dept. of Economics.
STRATEGIES FOR DIVERSIFICATION OF DEFENSE/SPACE COMPANIES
Murray L. Weidenbaum Jun. 1967 40 p refs *Its* Working Paper 6704
(Grant NsG-342)
(NASA-CR-84805) CFSTI: HC $3.00/MF $0.65 CSCL 05A

Specific guidelines are developed for defense/space companies desiring to utilize their specialized capabilities in other markets. The positive approach presented consists of a blend of the lessons from past defense/space marketing and diversification experiences and the concepts and methodology of modern business planning. Five areas of potential market diversification are examined: surface transportation, hydrography or water systems, communication systems, atmospheric research and control, and area development. An enumeration is made of the specific factors to be analyzed in selecting one or more of these fields for defense/space industry diversification. Author

N67-22428*# Missouri Univ., Columbia. Research Center.
THE NATURE AND SCOPE OF AGGLOMERATION EFFECTS OF CITY SIZE AND ADVANCED SCIENTIFIC TRAINING ON INDUSTRIAL RESEARCH LABORATORIES
John C. Murdock 22 Mar. 1967 54 p refs
(Grant NGR-26-004-012)
(NASA-CR-83395) CFSTI: HC $3.00/MF $0.65 CSCL 05I

The concentration of inventive activity in industrial areas is investigated. Urbanization, localization, and large-scale effects associated with the size of the operation of a single decision unit at a particular location are considered, as well as agglomeration variables such as size of city, and local facilities for advanced training in science. The tie between Ph. D. production and availability of local facilities is reflected in respondents replies, and results of the Chi-square tests involving the various elements of the industrial research laboratories operational environment and local Ph.D. production are tabulated. Factors such as the homogeneity of the statistical sample, tests for representativeness of response by geographic area and different city sizes, and the appropriateness of the universe from which the sample was drawn are all taken into consideration. R.LI.

N67-12157*# Missouri Univ., Columbia. Business and Public Administration Research Center.
RESEARCH AND REGIONS. A KWIC INDEXED BIBLIOGRAPHY

John C. Murdock and Judith Graves, comp. [1966] 228 p refs
(Grant NGR-26-004-012)
(NASA-CR-8009

A bibliography of works that include relevant references to location and regional development and to the economics and administration of research is presented. The publication illustrates a novel application of data processing techniques to the broader problems of information retrieval in economics. Its aim is to provide material for certain specialized areas in economics and administration and to apply recently developed computerized techniques to the field of economics and administration. S.P.

N66-30366*# National Aeronautics and Space Administration, Washington, D. C.
PROCEEDINGS OF THE FIFTH NATIONAL CONFERENCE ON THE PEACEFUL USES OF SPACE
1966 212 p refs Conf. held in St. Louis, 26-28 May 1965
(NASA-SP-82) GPO: HC $1.50; CFSTI: MF $0.65 CSCL 22A

Accomplishments in space exploration programs; manned space flight programs; and scientific space research projects are reviewed. Goals and future programs concerning the space exploration challenge are examined. Space research influences on industry and the economy, on science and education, on communications, on business opportunities, and on urban and regional development, are discussed. The social consequences of the space age are also discussed. L.S.

N65-19898*# George Washington Univ., Washington, D. C.
SCIENCE, TECHNOLOGY, AND THE NATIONAL POSTURE Note No. 1
Addison M. Rothrock Dec. 1964 10 p refs
(Grant NsG-727)
(NASA-CR-57435) CFSTI: HC $1.00/MF $0.50

The major importance of the nation achieving preeminence in technology and science is the keynote of the speech. Three major break-throughs are mentioned: nuclear power, the transistor, and manned space flight. The achievements of the space program, the cost and its potential for the future are discussed. The nation must grasp the fundamental fact that great discoveries will require public support and therefore public understanding before they can be brought to fruition. E.E.B.

N65-19894*# George Washington Univ., Washington, D. C.
SCIENCE IN NATIONAL POLICY—A PRELIMINARY INQUIRY Paper No. 1
Vincent P. Rock Nov. 1964 43 p refs Speech given in 1964 1965 Distinguished Lecture Ser., Sci., Bur. of Metropol. Washington Board of Trade, 21 Oct. 1964
(Grant NsG-727)
(NASA-CR-57428) CFSTI: HC $2.00/MF $0.50

To attain our goal of the "great society" we must have science in policy. This involves large-scale support of fundamental research in the social as well as the physical sciences. Scientific knowledge must be organized and applied to the major problems of national and international life. New means are reqiuired for rapidly diffusing the scientific knowledge needed in daily life. Society needs better methods for making the strategic choices between present desires and future needs, between individual acquisition and social progress. Finally, scientific knowledge is essential to permit the sustained development of a viable sense of community. Each of these elements of science in policy is examined with a view to suggesting new directions for action. Author

N65-19873*# George Washington Univ., Washington, D. C.
INTERACTION OF UNITED STATES OBJECTIVES IN SPACE WITH THOSE ON EARTH Program of Policy Studies in Science and Technology Paper No. 2
Vincent P. Rock Nov. 1964 19 p
(Grant NsG-727)
(NASA-CR-57485) CFSTI: HC $1.00/MF $0.50

The space program of the United States can make a substantial contribution to domestic economic progress. Besides invigorating the economy as a whole, space research should provide an opportunity for raising the skills and educational standards of a portion of the population. The needs of the whole society must be considered if the exploration of outer space is to be integrated into national life. The mastery of the environment of the solar system should be the primary goal in space. On earth the United States should seek leadership of a worldwide program directed to strengthening the bonds of common interest among the nations of the world. Author

N63-83519* RAND Corp., Santa Monica, Calif.
PUBLIC OPINION AND SOCIAL EFFECTS OF SPACE ACTIVITY
Joseph M. Goldsen 20 Jul. 1959 15 p refs
(Contract NASw-91)
(NASA-CR-50493; RM-2417-NASA)

Presented is a discussion of American public reaction to Soviet success in the space race; the response of Congress in relation to public opinion; objectives and programs of NASA's information activities; the impact of space activities on education and training; and broad social and economic implications of the space era. Author

N63-80944* National Aeronautics and Space Administration, Washington, D. C.
ADMINISTRATION AND UTILIZATION OF GOVERNMENT-OWNED PATENT PROPERTY
Archie M. Palmer 23 Dec. 1960 74 p refs
(Contract NASw-177)

Acquisition of government-patent rights, administration of patent rights, commercial exploitation and utilization, and operation of a licensing program are covered in a survey of government-owned patent property in the United States, Canada, and Great Britain. Possible courses of action are summarized. Individual government agencies could continue traditional policy of administering the patents under their administration jurisdiction, although this procedure is not considered in the public interest. A second course of action would be to dedicate the government's entire patent portfolio to the public, subject to security contraints, for free and unregulated use. A third course is for individual agencies to institute a program to obtain wide commercial and industrial use of patents under government jurisdiction. The fourth suggestion, considered most practical from cost and utilization points of view, is for the government to establish a facility similar to those in Great Britain and Canada that administer all government-owned patent property. M.W.R.

N63-23071* American Academy of Arts and Sciences, Cambridge, Mass. Committee on Space
BUSINESSMEN REVIEW THE SPACE EFFORT
Edward E. Furash Repr. from Harvard Business Rev., v. 41, no. 5, Sept.-Oct. 1963 21 p refs
(NASA Grant NsG-253-62)
(NASA CR-51798)

Businessmen continue to believe strongly that the Nation's space program is both worthwhile and important. But the novelty of space has worn off, and their enthusiasm has

a distinctly different cast to it. Executives are considerably better informed about the space program now than they were in 1960, and this knowledge is reflected in a more critical examination of the space program and the issues surrounding it. Whether as a function of passing time or of their increased knowledge, businessmen appear to have put the space program in perspective. For example, there is general agreement that space spending is just about right and that a speedup is not a matter of high priority. I.v.L.

N63-21126*# National Aeronautics and Space Administration, Washington, D. C.

CONFERENCE ON SPACE-AGE PLANNING

1963 301 p refs Presented at the 3rd Natl. Conf. on the Peaceful Uses of Space, Chicago, 1–9 May 1963

(NASA-SP-40)

Information regarding the National Space Program; the university–industry partnership in space projects; the effect of space activities on changing the economy; consumer goods and business opportunities from space research; the placement and management of research and development projects; and the opportunities and challenges in space procurement, is presented. L.S.

IAA ENTRIES

M1 PROGRAM MANAGEMENT

A67-43051 *#
LONG-RANGE PLANNING FOR THE DEEP-SPACE NETWORK.
E. Rechtin (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 4th, Anaheim, Calif., Oct. 23-27, 1967, Paper 67-975. 11 p.
Members, $1.00; nonmembers, $1.50.

The paper discusses some of the technical and management aspects of Deep-Space Network (DSN) planning, showing the reasoning behind both implementation and rejection of possible new capabilities. The principal objective of planning for the DSN is to delineate the future directions necessary to produce a high-performance network for lunar and planetary flight support at a reasonable cost. Planning, as an integral function of the management of the DSN, is closely related to the organization of its applied research. (Author)

A67-22291 *
RELIABILITY AND PROGRAM DECISION MAKING.
C. S. Bartholomew (Boeing Co., Aerospace Group, Space Div., Kent, Wash.).
IN: 1967 ANNUAL SYMPOSIUM ON RELIABILITY, WASHINGTON, D.C., JANUARY 10-12, 1967, PROCEEDINGS. [A67-22286 09-34]
Symposium sponsored by the Institute of Electrical and Electronics Engineers, the Institute of Environmental Sciences, the Society for Nondestructive Testing, and the American Society for Quality Control.
New York, Institute of Electrical and Electronics Engineers, Inc., 1967, p. 148-161. 5 refs.
NASA-sponsored research.

Illustration of the manner in which reliability can be used to improve the quality of program and design decisions during program definition and preliminary design. The illustration is done using an actual spacecraft development program as an example. Ways are suggested for extending the process to other program phases. Factors influencing the sensitivity of mission value to spacecraft reliability are the requirement for complex maneuvers and the operation of television cameras millions of miles and thousands of hours after launch, the limited launch windows occurring at 25-month intervals plus the usual constraints on cost, weight, and schedule. M.M.

A67-20966 * #
MANAGEMENT SYSTEMS PLANNING ON NEW FLIGHT PROGRAMS.
Peter K. Hatt (NASA, Washington, D.C.).
American Astronautical Society, National Conference on the Management of Aerospace Programs, University of Missouri, Columbia, Mo., Nov. 16-18, 1966, Paper AAS 66-141. 24 p.

Discussion of the use of quantitative and qualitative management systems for control and information within the framework of the Voyager program. The methods by which these management systems aid in solving problems at the conceptual phases of a flight program are reviewed. Problems encountered in implementation of the systems are dealt with. Specifically treated are the concept of controlled schedule milestones, work breakdown structures, scheduling systems, data and configuration management, and fiscal and manpower control and reporting. A discussion of how the development of a work breakdown structure early in the life cycle of the program is helpful in defining the coverage and application of management systems is included. F.R.L.

A66-39516
HISTORY AND MANAGEMENT OF THE LEM PROGRAM IN RCA.
F. J. Gardiner (Radio Corporation of America, Defense Electronic Products, Aerospace Systems Div., LEM Program Office, Burlington, Mass.).
IN: THE LEM PROGRAM AT RCA.
Camden, N.J., Radio Corporation of America, 1966, p. 2-4.

Brief history of the RCA participation in the Lunar Excursion Module (LEM) program. Early RCA Apollo mission studies and initial assignments are discussed. Program management techniques and observations of RCA are outlined, and several factors found to be important to successful program operation are specified. B.B.

A66-37973 #
THE UNIQUE MANAGEMENT ROLE IN THE NASA SPACE APPLICATIONS PROGRAM.
Morris Tepper (NASA, Office of Space Science and Applications, Washington, D.C.).
IN: ANNALS OF RELIABILITY AND MAINTAINABILITY. VOLUME 5 - ACHIEVING SYSTEM EFFECTIVENESS; ANNUAL RELIABILITY AND MAINTAINABILITY CONFERENCE, 5TH, NEW YORK, N.Y., JULY 18-20, 1965, PAPERS. [A66-37879 20-15]
Conference sponsored by the American Institute of Aeronautics and Astronautics, the Society of Automotive Engineers, and the American Society of Mechanical Engineers.
New York, American Institute of Aeronautics and Astronautics, 1966, p. 948-950.

Brief description of NASA activity in space applications and discussion of the unique management problems dealt with in the NASA Office of Space Applications. A number of peaceful applications of space technology are cited, as well as the sequence followed in establishing these applications. The dual role of the Office of Space Applications as both customer and supplier is emphasized. A.B.K.

A66-34065
TOTAL EVALUATION FOR MANAGEMENT PURPOSES OF ENGINEERING AND SCIENTIFIC TASKS.
Lazarus Lebanoff (NASA, Kennedy Space Center, Delta Operations Branch, Western Test Range, Lompoc, Calif.).
IEEE Transactions on Engineering Management, vol. EM-13, June 1966, p. 110-122. 13 refs.

Analysis of a system for reporting to management on the progress of scientific and engineering projects. The hypothesis on which the study is based is that critical elements of information affecting technical projects can be isolated and meaningful quantitative measures of them can be established to assess technical progress. It is confirmed that an analysis procedure can be developed for transmutation of the quantified data into meaningful indicators for management. B.B.

A66-30364 #
THE PROBLEMS OF PREPARING FOR NEW SPACECRAFT PROGRAMS.
Peter N. Haurlan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
IN: VIRGINIA POLYTECHNIC INSTITUTE, CONFERENCE ON THE EXPLORATION OF MARS AND VENUS, VIRGINIA POLYTECHNIC INSTITUTE, BLACKSBURG, VA., AUGUST 23-27, 1965, PROCEEDINGS. [A66-30350 16-30]
Conference supported by the National Aeronautics and Space Administration, and the U. S. Air Force Cambridge Research Laboratories.
Blacksburg, Va., Virginia Polytechnic Institute, 1965, p. XIV-1 to XIV-16.

Description of the process of program selection for future spacecraft projects. The criteria used are indicated, the efforts required are determined, the types of problems involved are discussed, and the roles of the space scientist and the industrial manager are defined. The use of parametric analysis of candidate missions to attain a cursory understanding of mission characteristics over a broad range of parameters and to uncover potential problem areas for later, more detailed studies is illustrated in the case of the development of spacecraft design concepts for a Jupiter "flyby" mission. A.B.K.

A66-23437 #
MANNED SPACE FLIGHT PROGRAM MANAGEMENT.
Samuel C. Phillips (NASA, Washington, D.C.).
IN: ELECTRONIC INDUSTRIES ASSOCIATION, CONFERENCE ON SYSTEMS EFFECTIVENESS, 1ST, WASHINGTON, D.C., OCTOBER 19, 20, 1965, PROCEEDINGS. [A66-23434 11-34]
Washington, D.C., Electronic Industries Association, 1965, p. 28-37.

Discussion of the philosophy and fundamental concepts underlying the quantitative approach to systems effectiveness. The baseline for quantitative measurement of systems effectiveness is the requirement established for any given system. Some factors involved in the Apollo program which are applicable to the measurement of systems effectiveness are described, including a program calendar, cost factors, reliability concepts, and performance reports. The manner in which mathematical reliability models can be used to determine the optimum application of backups, redundancy, reliability improvement, and test verification is described.
D.P.F.

A65-30144 #
MANAGING THE MARINER MARS PROJECT.
Jack N. James (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
Astronautics and Aeronautics, vol. 3, Aug. 1965, p. 34-41.

Discussion of the management features involved in the Mariner Mars project. The role of management in system design, establishment of the launch period, formulation of the project development plan, and parts procurement is discussed. The anticipation of crises in the development of the project and planned reserve resources for coping with them are also considered. S.H.B.

A65-11454 #
INTEGRATING SPACECRAFT SYSTEMS.
Allen L. Franta (NASA, Goddard Space Flight Center, Greenbelt, Md.).
IN: INTERNATIONAL SPACE ELECTRONICS SYMPOSIUM, LAS VEGAS, NEV., OCTOBER 6-9, 1964, RECORD.
New York, Institute of Electrical and Electronics Engineers, Space Electronics and Telemetry Group, 1964, p. 3-b-1 to 3-b-14.

Discussion of the integration of a spacecraft system into a single entity combining the mechanical and electrical subsystems through the application of logical processes, taking into account the physical and functional aspects of the subsystem relationship. The efforts involved are specified as: (1) project management integration, (2) integration of physical systems, and (3) integration by subsystem combination through advanced design. V.Z.

A64-23651
NASA'S RELIABILITY REQUIREMENTS.
John E. Condon (NASA, Office of Reliability and Quality Assurance, Washington, D.C.).
IN: AMERICAN SOCIETY FOR QUALITY CONTROL, ANNUAL CONVENTION, 18TH, BUFFALO, N.Y., MAY 4-6, 1964, TRANSACTIONS.
Edited by Irving W. Burr.
Milwaukee, American Society for Quality Control, Inc., 1964, p. 96-101.

Discussion of the major elements of NASA's reliability program requirements incorporated in the publication NPC 250-1, reliability program provisions for space system contractors. The principal elements cited in NPC 250-1 are: (1) program management, (2) reliability engineering, and (3) testing and reliability evaluation. Each of these elements is discussed in detail, and some of the important tasks and activities related to each are pointed out. It is stated that NASA expects its contractors to have a thoroughly planned reliability program with major emphasis on reliability engineering utilizing a test and evaluation program to ascertain progress towards the attainment of system reliability requirements.

A64-22577
PROGRAM MANAGEMENT IN DESIGN AND DEVELOPMENT.
J. R. Dempsey (General Dynamics Corp., General Dynamics/-Astronautics, San Diego, Calif.), W. A. Davis (USAF, Systems Command, Ballistic Systems Div., Norton AFB, Calif.), A. S. Crossfield (North American Aviation, Inc., Space and Information Systems Div., Downey, Calif.), and Walter C. Williams (NASA, Manned Spacecraft Center, Houston, Tex.).
IN: ANNUAL AEROSPACE RELIABILITY AND MAINTAINABILITY CONFERENCE, 3RD, WASHINGTON, D.C., JUNE 29-JULY 1, 1964, PROCEEDINGS.
New York, N.Y., Society of Automotive Engineers, Inc., 1964, p. 1-22.

Presentation of questions and answers to a set of standard questions put to the various panel members on a number of significant program management problems. The responses reflect the authors' experience in management of the test and assurance aspects of aerospace vehicle development and production. Emphasis is placed on the need for analysis and identification of the critical areas in design, manufacture and operation for control of all the significant factors affecting product effectiveness, and for testing to verify the suitability of the product for its intended use.

A63-18981
SYSTEMS ENGINEERING FOR MANNED SPACE FLIGHT.
Joseph F. Shea (NASA, Office of Manned Space Flight, Washington, D.C.).
IN: 2nd Manned Space Flight Meeting. New York, American Institute of Aeronautics and Astronautics, 1963, p. 4-8.

General review of approaches to the manned lunar landing program, emphasizing the systems engineering function within the Office of Manned Space Flight (OMSF). The role of the systems engineering organization in the program team is considered, examples being taken from Bell Telephone Laboratories, and the Ballistic Missile Program. The systems engineering role in OSMF is intended to provide program-wide technical analysis for management, to insure that functional and performance requirements placed on all elements of a system are within the present or projected state-of-the-art and can be developed within the scope of the project.

A63-16601
MANAGEMENT OF MANNED SPACE PROGRAMS.
Wernher von Braun (NASA, George C. Marshall Space Flight Center, Huntsville, Ala.)
(National Advanced-Technology Management Conference, Proceedings, Seattle, Wash., Sept. 4-7, 1962.)
IN: Science, Technology, and Management. New York, McGraw-Hill Book Co., Inc., 1963, p. 248-262.

Detailed discussion of the organization and management of the Marshall Space Flight Center. The organization of the space-launch-vehicle programs is described, with particular attention to the Saturn-Apollo program. The role of the Saturn Systems Office is discussed, and the utilization of the project concept is stressed. The difficulties involved in individual motivation in large-scale projects requiring vast human and material resources are considered, together with the active government-industry cooperation in major new space projects.

M2 CONTRACT MANAGEMENT

A67-37623 * #
TRENDS IN CONTRACTING THAT WILL INFLUENCE SPACECRAFT DESIGN AND DEVELOPMENT.
Edmund F. O'Connor (NASA, Marshall Space Flight Center, Huntsville, Ala.).
American Institute of Aeronautics and Astronautics, Space Program Issues of the 70's Meeting, Seattle, Wash., Aug. 28-30, 1967, Paper 67-641. 6 p.
Members, $0.75; nonmembers, $1.50.

Substantiation of the thesis that contracting trends will be an influencing factor in spacecraft design and development in the 1970s. Trends in development of procurement concepts and contracting practices of the present time are reviewed; improvement brought about by incentive contracts is cited; and the possible evolution of this principle to fulfill future space systems requirements is explained. The most critical incentive factor seen in future space systems contracts is expected to be reliability, as it will effect cost, mission accomplishment, system life and usefulness, and program progress. In addition to greatly improved design, more ground testing, more flight and space environmental stimulation, and more actual assurance of reliability is foreseen, even in the face of much more complex and more costly systems, longer duration missions, and the yet-to-be-determined impediments of interplanetary travel. Advancements in contracting technology will continue to influence the designer and the systems manager in their endeavors and achievements toward the space exploration goals of the future. P. v. T.

A67-21287 *

EFFECTS OF INCENTIVE CONTRACTS IN RESEARCH AND DEVELOPMENT - A PRELIMINARY RESEARCH REPORT.

E. B. Roberts and J. B. Sloat (Massachusetts Institute of Technology, Sloan School of Management, Cambridge, Mass.).

IEEE Transactions on Engineering Management, vol. EM-13, Dec. 1966, p. 181-187. 6 refs.

Grant No. NsG-235.

Five research and development contracts that were converted from a cost reimbursement basis to a form of cost incentive contract were studied by interviews with government and contractor personnel associated with the projects. The analyses of these contracts indicate that during negotiations for incentive conversions, contractors avoid risk by some combination of stalling and allowing time to reduce technical uncertainty or by refusing to negotiate agreements that contain cost sharing possibilities. Little evidence was found that would support the theoretical assertion that contractors would alter their behavior to seek the improved profits possible under R and D incentive contracts. It appears that contractors monitor and control contract change more carefully on incentive contracts than on Cost-Plus-Fixed-Fee contracts. Contract change is revealed to be a major problem on technically complex and uncertain tasks and may cause contract outcome to be more a result of negotiation skills than of the operation of contractual incentives. (Author)

A67-19470 *

SOME ASPECTS OF THE STATE DISTRIBUTION OF MILITARY PRIME CONTRACT AWARDS.

Edward Greenberg (Washington University, Dept. of Economics, Seattle, Wash.).

Review of Economics and Statistics, vol. 48, May 1966, p. 205-210. 9 refs.

Grant No. NsG-342.

Investigation of relationships between the state distribution of military prime contract awards for experimental and developmental work, tests, and research, and the state distribution of total military prime contract awards. Some of the conclusions reached are: (1) EDTR contract awards proved to be very successful in explaining the distribution of prime contract awards among states; (2) an estimation of the lag structure relating EDTR to procurement awards was obtained; and (3) the type of research institution receiving the EDTR award does not seem to have had any effect on the amount of procurement awards eventually received. M.M.

M3 RESEARCH & DEVELOPMENT

A66-34064

STUDIES OF THE PROBLEM-SOLVING PROCESS IN ENGINEERING DESIGN.

Thomas J. Allen (Massachusetts Institute of Technology, Alfred P. Sloan School of Management, Cambridge, Mass.).

(Institution of Electrical Engineers, Conference on Electronics Design, London, England, Feb. 8, 9, 1965, Paper.)

IEEE Transactions on Engineering Management, vol. EM-13, June 1966, p. 72-83. 7 refs.

NSF Grants No. GN-233; No. GN-353; Grant No. NsG-235-62.

Three sets of parallel research and development projects are examined. The data analyzed were gathered by means of Solution Development Records - a form which provides a weekly estimate of the probability of adoption of the approaches under consideration as possible solutions to a technical problem. It is found that the longer an approach is held in a favored position, the more difficult it is to reject. Furthermore, the number of alternative technical approaches considered bears a relation to judged solution quality. Groups producing higher rated solutions generated fewer approaches during the course of the project, and they more closely approach an ideal strategy of trading approaches off on a two-at-a-time basis than do their poorer performing rivals. The selection of technical information sources by the engineers and scientists is found to be dependent upon the function to be performed and related to the particular time phase in which the project happens to be. (Author)

A64-23347

RESEARCH PROJECT SELECTION - TESTING A MODEL IN THE FIELD.

William H. Pound (Northwestern University, Technological Institute, Dept. of Industrial Engineering and Management Science, Evanston, Ill.).

IEEE Transactions on Engineering Management, vol. EM-11, Mar. 1964, p. 16-22. 7 refs.

Results of a field test of a procedure for evaluating research projects. The procedure, based on what is termed an expected-value model, considers the following decision elements: (1) the environment of the problem, (2) the decision maker, (3) his objectives, and (4) his alternatives. The decision maker's alternatives, in this case a number of potential research projects, are evaluated in the light of his objectives. The result of the procedure is a ranking of potential projects in terms of their expected values. This procedure was tested in a research laboratory by having four decision makers evaluate a selected list of research projects. The resulting ranking of the projects was found to agree with an intuitive evaluation by the decision makers of the same list of projects. This gives an indication that the expected-value model may be useful in the complex area of research project selection.

A64-11478

ASTRONAUTICAL RESEARCH AND DEVELOPMENT.

Eugene J. Manganiello (NASA, Lewis Research Center, Cleveland, Ohio).

AIAA Student News Reporter, vol. 7, Oct. 1963, p. 6-9.

Discussion of the challenges created by the aerospace program. The history of research and development in the United States is traced. Reliability is considered the single greatest challenge. Among the problems arising among the projects of the NASA Lewis Research Center are discussed are those that are associated with the Centaur launch vehicle, the F-1 engine, nuclear and electric rocket propulsion, and the technical management area.

M4 MANAGEMENT TOOLS & TECHNIQUES

A67-30222 *

THE USE OF NETWORK PLANNING IN THE U.S. SPACE PROGRAM.

Walter W. Haase (NASA, Management Information Systems Div., Washington, D.C.).

IN: INTERNATIONAL COMPUTERS AND TABULATORS, NETWORK PLANNING USERS CONFERENCE, LONDON, ENGLAND, JUNE 8, 1967, PAPERS. [A67-30221 15-34]

London, International Computers and Tabulators, Ltd., 1967, p. 27-41.

Brief description of various applications of the Program Evaluation and Review Technique (PERT) in NASA, the NASA-PERT and Companion Cost System, covering the relationship between PERT and reporting to top management, and the effectiveness and limitations of the PERT system. Various aspects of PERT operations are presented in diagram form. It is indicated that the proper implementation of PERT has already been effective but requires time for a more extensive realization. V.Z.

A67-27558 *

GEMINI INCENTIVE PROGRAM MODEL.
W. C. Schneider (NASA, Washington, D.C.).
(American Astronautical Society, National Conference on the Management of Aerospace Programs, University of Missouri, Columbia, Mo., Nov. 16-18, 1966, Paper AAS 66-157.)
IN: THE MANAGEMENT OF AEROSPACE PROGRAMS; AMERICAN ASTRONAUTICAL SOCIETY, NATIONAL CONFERENCE, UNIVERSITY OF MISSOURI, COLUMBIA, MO., NOVEMBER 16-18, 1966, PROCEEDINGS. [A67-27545 13-34]
Edited by W. L. Johnson.
Tarzana, Calif., American Astronautical Society (AAS Science and Technology Series. Volume 12), 1967, p. 301-321.
[For abstract see issue 08, page 1430, Accession no. A67-20974]

A67-27555 *

PROGRAM TREND LINE ANALYSIS, AN AID TO GENERAL MANAGEMENT.
T. E. Jenkins (NASA, Program and Special Reports Div., Washington, D.C.).
(American Astronautical Society, National Conference on the Management of Aerospace Programs, University of Missouri, Columbia, Mo., Nov. 16-18, 1966, Paper AAS 66-156.)
IN: THE MANAGEMENT OF AEROSPACE PROGRAMS; AMERICAN ASTRONAUTICAL SOCIETY, NATIONAL CONFERENCE, UNIVERSITY OF MISSOURI, COLUMBIA, MO., NOVEMBER 16-18, 1966, PROCEEDINGS. [A67-27545 13-34]
Edited by W. L. Johnson.
Tarzana, Calif., American Astronautical Society (AAS Science and Technology Series. Volume 12), 1967, p. 229-260.
[For abstract see issue 08, page 1430, Accession no. A67-20973]

A67-27551 *

PROGRAM BUDGETING AND THE SPACE PROGRAM.
Murray L. Weidenbaum (Washington University, Dept. of Economics, St. Louis, Mo.; NASA, Washington, D.C.).
(American Astronautical Society, National Conference on the Management of Aerospace Programs, University of Missouri, Columbia, Mo., Nov. 16-18, 1966, Paper AAS 66-150.)
IN: THE MANAGEMENT OF AEROSPACE PROGRAMS; AMERICAN ASTRONAUTICAL SOCIETY, NATIONAL CONFERENCE, UNIVERSITY OF MISSOURI, COLUMBIA, MO., NOVEMBER 16-18, 1966, PROCEEDINGS. [A67-27545 13-34]
Edited by W. L. Johnson.
Tarzana, Calif., American Astronautical Society (AAS Science and Technology Series. Volume 12), 1967, p. 157-170. 5 refs.
Grant No. NsG-342.
[For abstract see issue 08, page 1430, Accession no. A67-20970]

A67-20974 * #

GEMINI INCENTIVE PROGRAM MODEL.
William C. Schneider and William A. Summerfelt (NASA, Washington, D.C.).
American Astronautical Society, National Conference on the Management of Aerospace Programs, University of Missouri, Columbia, Mo., Nov. 16-18, 1966, Paper AAS 66-157. 22 p.

Description of the planned interdependency incentive method (PIIM) designed to assist the Gemini Spacecraft Program in achieving a high degree of performance at a cost as low as possible. A PIIM structure in the form of a three-dimensional surface is developed to determine the most favorable cost/performance ratio for the program. The elevation of the surface defines the corporation fee as a function of cost and performance coordinates, at any given moment. The fee surface is bounded on two sides by limits of the maximum allowable and minimum probable cost levels and by the maximum acceptable and minimum acceptable performance on the other two sides. V.Z.

A67-20973 * #

NASA PROGRAM TREND LINE ANALYSIS.
T. E. Jenkins (NASA, Program and Special Reports Div., Washington, D.C.).
American Astronautical Society, National Conference on the Management of Aerospace Programs, University of Missouri, Columbia, Mo., Nov. 16-18, 1966, Paper AAS 66-156. 33 p.

Description of program trend line analysis and certain things learned from it. Examples are cited to show that NASA management must possess at all times a realistic appraisal of development time schedules. Such appraisals place management in the position of controlling rather than being controlled by the dynamics of operations. The basic device used in program trend-line analysis is the time/time plot. F.R.L.

A67-20970 * #

PROGRAM BUDGETING AND THE SPACE PROGRAM.
Murray L. Weidenbaum (Washington University, Dept. of Economics, St. Louis, Mo.; NASA, Washington, D.C.).
American Astronautical Society, National Conference on the Management of Aerospace Programs, University of Missouri, Columbia, Mo., Nov. 16-18, 1966, Paper AAS 66-150. 15 p. 7 refs.
Grant No. NsG-342.

Description of the main features of the Planning-Programing-Budgeting System (PPBS) effort, and analysis of possible applications to and impacts on space activities. By raising fundamental questions concerning the alternative uses of Federal funds and resources, and by providing some concepts and methodology for answering them, it is considered that PPBS is an important attempt to sharpen the government's budgetary preparation and review process. It may ultimately increase the benefits received by the nation from its public investments and outlays. F.R.L.

A67-11805 *

THE LANGLEY RESEARCH CENTER REMOTE COMPUTING TERMINAL SYSTEM - IMPLEMENTATION AND FIRST YEAR'S OPERATION.
Roger V. Butler (NASA, Langley Research Center, Hampton, Va.).
IN: ASSOCIATION FOR COMPUTING MACHINERY, NATIONAL CONFERENCE, 21ST, LOS ANGELES, CALIF., AUGUST 30-SEPTEMBER 1, 1966, PROCEEDINGS. [A67-11798 02-08]
Washington, D.C., Thompson Book Co. (ACM Publication P-66), 1966, p. 139-148. 5 refs.

Description of the remote computing terminal system installed at the NASA Langley Research Center in support of open-shop programing, with discussion of the experience gained from using and managing it. The computer center utilizes a direct coupled system composed of an IBM 7094 and a 7040 coupled together for core-to-core transmission. The 7094 does the compilation and the 7040 manages the information flow. System functions and implementation are examined, and programer training, monitoring of system performance, and system management, maintenance, and cost are discussed. F.R.L.

A66-19460

A COMPARISON OF ACTUAL AND ALLOCATED COSTS FOR WORK ACCOMPLISHED USING NASA PERT.
J. D. Walker and E. Houry (NASA, Lewis Research Center, Cleveland, Ohio).
IEEE Transactions on Engineering Management, vol. EM-12, Sept. 1965, p. 93-102.

A system for more objectively evaluating a contractor's performance on cost type contracts is described. The technique

utilizes the existing NASA PERT and Companion Cost System without imposing any additional reporting requirements upon the contractor. Evaluation is obtained by a cost index which is calculated monthly and is a comparison of the contractor's actual costs incurred with baseline allocated costs. The allocated costs result from a reasonable distribution or allocation of the contractor's initial cost proposal dollars to activities reflecting this proposal in PERT fragnets. After this initial allocation, the computer calculates with each normal PERT Time updating, the allocated costs, or the total-resources-allocated-for-work-accomplished through the report date. The results of a pilot test case using the cost index are presented. (Author)

A65-23610 #
PREDICTION ANALYSIS AND MANAGEMENT DECISIONS.
Gilbert L. Roth and Carl R. Liebermann (NASA, Office of Manned Space Flight, Apollo Program Control Directorate, Performance Analysis and Control Group, Washington, D. C.).
IN: NEW DIMENSIONS IN SPACE TECHNOLOGY; SPACE CONGRESS, 2ND, COCOA BEACH, FLA., APRIL 5-7, 1965, PROCEEDINGS. [A65-23599 13-31]
Congress sponsored by the Canaveral Council of Technical Societies Cocoa Beach, Canaveral Council of Technical Societies, 1965, p. 130-151. 10 refs.

Discussion of the need in the Apollo program for accurate predictions of system weight, performance, power requirements, and other parameters. To meet this need and provide decision bases upon which to act, the Apollo Program Control Directorate of NASA Headquarters has under continuous development rigorous prediction analysis techniques (PAT) necessary to detect potential weaknesses before they become critical. This work is presently pointed toward predictions of space vehicle weight and performance as related to schedules, cost, and reliability. The prediction analysis technique described here combines applicable domains of classical statistical methods, relevancy devices, mathematical modeling, management decision criteria, electronic computer usage, hardware tradeoff, and error analyses. The techniques developed are not a cure-all, but are said to provide engineering and program managers with the data necessary to pinpoint critical issues, define courses of action, and thereby factually support technical and management judgments. (Author) D. H.

A65-12577
SUMMARY OF MANAGEMENT AND OPERATIONAL PHILOSOPHY.
Paul E. Purser (NASA, Manned Spacecraft Center, Houston, Tex.).
IN: MANNED SPACECRAFT - ENGINEERING DESIGN AND OPERATION.
Edited by Paul E. Purser, Maxime A. Faget, and Norman F. Smith. New York, Fairchild Publications, Inc., 1964, p. 491-495. 5 refs.

Discussion of the general management and operational philosophies of manned spacecraft programs. Progress and cost estimation methods are reviewed, including the Program Evaluation and Review Technique (PERT). A technical management procedure involving the establishment of panels of technical personnel from different organizations concerned with the project is described. Difficulties arising from cost-plus-fixed-fee contracts are discussed. Basic operational considerations are described, covering mission, ground-network, preflight, mission-control, and training preparations. P. K.

A64-20781
PLANNING A LEAST COST RELIABILITY CONSTRAINED DEVELOPMENT PROGRAM - A CAPACITATED NETWORK APPROACH.
Paul M. Carrick, Jr. (General Electric Co.-TEMPO, Santa Barbara, Calif.).
American Institute of Aeronautics and Astronautics, Annual Meeting, 1st, Washington, D. C., June 29-July 2, 1964, Paper 64-410. 10 p. 13 refs.
Members, $0.50; nonmembers, $1.00.
Contract No. NASw-686.

Consideration of a method for estimating the resource requirements for any future, technically complex, development program. Specifically, the approach is designed to provide a minimum-cost test plan which will assure conformance to the reliability requirements and which, in addition, will satisfy the reliability constraint during the conduct of the more usual engineering experimental investigations. The proposed planning approach overlaps two categories of current research: first, it represents a slight extension of PERT cost-logic in that it deals with selecting the least cost development path from a rather large set of alternative paths which are themselves defined by the existence of substitutability between resource inputs. Secondly, it represents a radical reorientation of the techniques for assuring conformance to the reliability requirement placed upon a program. Methodologically, the suggested approach constitutes an application of the capacitated network theory, which, in turn, is a form of linear planning.

A63-16131
INTEGRATING RELIABILITY PROGRESS INTO DESIGN AND ENGINEERING: A STUDY OF MANAGEMENT SYSTEMS. Appendix - A METHOD OF EXAMINING THE EFFECTIVENESS OF A FIRM'S RELIABILITY FUNCTION BY THE CREATION OF A MODEL ORGANIZATION.
Ronald S. Nelson (North American Aviation, Inc., Rocketdyne Div., Canoga Park, Calif.) and Alvin Steinberg (NASA, George C. Marshall Space Flight Center, Huntsville, Ala.)
(AIAA-SAE-ASME, Aerospace Reliability and Maintainability Conference, 1st, Washington, D. C., May 6-8, 1963.)
IN: Aerospace Reliability and Maintainability Conference, 1st. New York, American Institute of Aeronautics and Astronautics, 1963, p. 178-184.

Presentation of the results of a survey of aerospace-industry firms in order to determine the group responsible in each firm for selected reliability activities, and the extent of authority that their central reliability groups have for these activities. To aid each individual firm to optimize its reliability organization, a three-dimensional reliability checklist is included, together with criteria for its utilization. Twelve tasks are selected and an analysis is made of a development organization. In particular, the conduct of reliability tasks by nonreliability personnel is estimated, as related to the total effort of the organization. If a "norm" exists regarding what proportion of development is reliability, the analysis may provide the standard.

M5 PERSONNEL MANAGEMENT

A66-24957
ALERTNESS MANAGEMENT IN INDUSTRY.
J. A. Moody and B. C. Duggar (Bio-Dynamics, Inc., Cambridge, Mass.).
(American Industrial Hygiene Association, Annual Meeting, 26th, Houston, Tex., May 3-7, 1965, Paper.)
American Industrial Hygiene Association, Journal, vol. 27, Jan.-Feb. 1966, p. 17-24. 35 refs.
Contract No. NASw-904.

Study of alertness management which is critical to production rate, quality control and operator safety. Alertness management includes (1) elimination of factors conducive to alertness decrement, (2) addition of conditions or procedures which enhance alertness, (3) reduction of the consequences of alertness decrements, and (4) personnel monitoring when necessary. The criteria for evaluating the controlling elements in the task, physical environment, social environment, and procedures which may lead to decrements in alertness are discussed. Monitoring procedures are described and recommendations suggested which should lead to improved alertness management in the industrial situation. An alertness checklist is presented for use in analyzing particular job situations. M. F.

A64-26342 •
SOME SOCIAL IMPLICATIONS OF ORGANIZING FOR A SPACE EFFORT.
Robert L. Barre (NASA, Headquarters, Washington, D. C.).
IN: CONFERENCE ON SPACE SCIENCE AND SPACE LAW,

UNIVERSITY OF OKLAHOMA, NORMAN, OKLA., JUNE 18-20, 1963, PROCEEDINGS.
Conference sponsored by the College of Law of the University of Oklahoma; the Business and Industrial Services of the University of Oklahoma Extension Div.; the Frontiers of Science Foundation of Oklahoma, Inc.; the Liberty National Bank and Trust Co.; and the Oklahoma Bar Association.
Edited by Mortimer D. Schwartz.
South Hackensack, N. J., Fred B. Rothman and Co., 1964, p. 110-119.

Discussion of the importance of the coordinated, interrelated, contributory actions of many persons to the successful carrying out of a space effort. The effects of this process upon society are examined, as well as some of the organizational problems presented. Because successful space efforts require a very great increase in functional and intellectual specializations, the development of this differentiation in engineering and scientific disciplines is reviewed at some length. In considering examples of the complementary process of science integration, attention is given to new management techniques and to the role of specialists integrated into interdisciplinary teams for project purposes. The role of systems engineering is discussed, and the facilities established and controlled by NASA are described and evaluated.

A64-22651
THE ENGINEER IN U.S. SPACE RESEARCH.
Maxime A. Faget (NASA, Manned Spacecraft Center, Houston, Tex.).
Space World, vol. A-11, Sept. 1964, p. 10-13.

General discussion of the role of the spacecraft engineer in such space projects as Apollo, in terms of the government and the industrial engineer. The former group, it is noted, is responsible for the initial planning, initial design concepts, and feasibility studies. Also, in addition to direct contractor management, it is found desirable for the government to do a certain amount of testing and evaluation of hardware delivered to the contractor in order to as certain that it is spaceworthy equipment. Briefly discussed is the role of government engineers involved in the launch and flight operations, and the various assignments of engineers at the Manned Spacecraft Center in Houston, Tex., are delineated, in order to show the variety of skills called for.

A64-20062
MOTIVATION OF TECHNICAL PERSONNEL.
Michael J. Vaccaro (NASA, Goddard Space Flight Center, Greenbelt, Md.).
American Institute of Aeronautics and Astronautics, Annual Meeting, 1st, Washington, D.C., June 29-July 2, 1964, Paper 64-407. 7 p. Members, $0.50; nonmembers, $1.00.

Survey of aerospace research and development of general management and project management personnel to determine certain motivational factors involved in their work. Specifically studied are: (1) the question of which motivational elements serve as "stimulators" and which serve as "dissatisfiers," and (2) the extent to which the government's provision for incentive contracting assists these groups in establishing the climate for attracting and retaining the technical personnel necessary to satisfy the NASA program requirements. A questionaire and a checklist are employed in the study, which is limited to technical personnel.

A63-17931
THE INCREASING PROMINENCE OF THE ENGINEERING TECHNICIAN IN NASA.
Eugene J. Manganiello (NASA, Lewis Research Center, Cleveland, Ohio).
Society of Automotive Engineers, International Summer Meeting, Montreal, Canada, June 10-14, 1963, Paper 712B. 10 p.

Discussion of the role of the engineering technician in a government research and development organization, the NASA Lewis Research Center. The type of technicians, their duties, salary levels and opportunities are described and compared with the craftsman category. Included are statistics showing the distribution of personnel among the engineer, technician, craftsman, and administrative categories. Pro and con arguments for expanded use of technicians are presented.

M7 MANAGEMENT POLICY & PHILOSOPHY

A63-19028
SPACE POLICY AND SPACE MANAGEMENT.
Edward C. Welsh (NASA Headquarters, Washington, D.C.).
IN: 2nd Manned Space Flight Meeting. New York, American Institute of Aeronautics and Astronautics, 1963, p. 374-376.

Brief observations of the interrelationship between space policy and management. Stressed are the multi-project program, the basic features of the space policy, and its future characteristics.

A63-19025
GENERAL MANAGEMENT OF SPACE PROGRAMS INDUSTRY VIEWPOINT.
Walter F. Burke (McDonnell Aircraft Corp., St. Louis, Mo.).
IN: 2nd Manned Space Flight Meeting. New York, American Institute of Aeronautics and Astronautics, 1963, p. 364-369.

Consideration of the need for expanding the boundaries of the aerospace industry. Tables and graphs show the increase in production, expenditures for missile and space studies, salary classifications, and companies gained by acquisition, from 1951 to 1961, with extrapolations for expenditures to 1970. Examples of the growth in test facilities discussed include those for the Gemini and Mercury projects. The need for more trained manpower is emphasized.

A63-11157
MANAGING THE NUCLEAR-ROCKET PROGRAM.
Harold B. Finger (AEC-NASA, Space Nuclear Propulsion Office, Washington, D.C.
Astronautics, vol. 7, Dec. 1962, p. 18-21.

Discussion of the management philosophy and organization of the U.S. nuclear-rocket program. Techniques for controlling and coordinating all program aspects are reviewed. In addition, advantages of nuclear rockets, in view of their payload capabilities over purely chemical systems, are pointed out.

M8 ECONOMICS

A67-23629 *
MEASUREMENTS OF THE ECONOMIC IMPACT OF DEFENSE AND SPACE PROGRAMS.
Murray L. Weidenbaum (Washington University, St. Louis, Mo.).
American Journal of Economics and Sociology, vol. 25, Oct. 1966, p. 415-426. 17 refs.
Grant No. NsG-342.

Discussion of the following aspects of the understanding of basic concepts of the economic impact of defense and space expenditures: (1) the current stock of information, (2) the increment soon to become available, and (3) the relatively high-priority gaps that need to be filled. It is concluded that despite the gaps in the available stock of information on the economic impact of defense and space programs, some useful findings can be obtained from the available data. Only a relatively few companies in a few regions tend to be either greatly benefited or adversely affected by defense and space programs at present. The bulk of the population, area, and industry of the country is only marginally influenced by defense and space programs.
M.M.

A66-20689* California Univ., Berkeley. Inst. of Business and Economic Research.
THE STRUCTURE AND PERFORMANCE OF THE AEROSPACE INDUSTRY

Herman O. Stekler 1965 223 p refs
(Grant NsG-243)

The market relationships between the government and private firms in the aerospace industry are examined. Major sources of information include published documents of the government's procurement agencies, Congressional hearings, and the trade journals. A theoretical framework for the study is presented. The number of firms in the industry is determined, and the role played by each type of firm is discussed. The nature and development of competetive practices; effects of type of contract awarded on financial risk; entry of firms into and exit from the industry; and estimates of the barriers to entry are discussed. The performance of the aerospace industry is judged, utilizing several new measures beyond traditional measures, to obtain sufficient data from which inferences may be drawn. L.S.

A65-10717 #
THE GOVERNMENT'S ATTITUDE TOWARD PROFIT.
Dave W. Lang (NASA, Manned Spacecraft Center, Houston, Tex.).
IN: AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, AND NASA, MANNED SPACE FLIGHT MEETING, 3RD, HOUSTON, TEX., NOVEMBER 4-6, 1964, TECHNICAL PAPERS (AIAA Publication CP-10).
New York, American Institute of Aeronautics and Astronautics, 1964, p. 353-355. 7 refs.

Review of changes in Government policies towards profits in the aerospace industry. Shortcomings in cost-plus-fixed-fee contracts are reviewed, and the increasing use of cost-plus-incentive-fee contracts is discussed. The role of competitive pressures in determining profit rates is noted. The incentive contract, with its basic philosophy of reward for good performance and penalty for poor, is concluded to offer the best opportunity for the contractor to achieve higher profits. P.K.

M9 GENERAL

A67-19467 *
THE FEDERAL GOVERNMENT'S PROPENSITY TO PATENT.
Donald Stevenson Watson and Mary A. Holman (George Washington University, Washington, D.C.).
Patent, Trademark, and Copyright Journal of Research and Education, vol. 10, Spring 1966, p. 61-74. 17 refs.
Grant No. NsG-425.

Discussion of data regarding the criteria used by the six largest Government patent departments in screening and evaluating inventions for patent applications during the postwar period. The agencies involved carry on about 97% of the Government's patent activity. Because of differences in their missions, Government agencies employ different criteria in selecting inventions for patent applications, with resulting variations in their propensities to patent. The propensities range from a low of 10% for the Air Force to a high of 80% for Agriculture. M.M.

A66-42242 #
GIVING FORM TO OUR SPACE GOALS - RECENT LESSONS AND NEW DIRECTIONS (First Annual Robert H. Goddard Lecture).
Robert C. Seamans, Jr. (NASA, Washington, D.C.).
(National Space Club, Lecture, Washington, D.C., Spring 1966.)
Astronautics and Aeronautics, vol. 4, Oct. 1966, p. 60-66.

Review of the dual demands of space projects - increased detailed knowledge and better correlation of many disciplines. Project planning from the concept through detailed study and analysis to the design, building, and testing of experimental equipment is discussed. The roles of universities, industry, and government in implementing projects receive attention. F.R.L.

A66-16076
GOVERNMENT RESEARCH AND DEVELOPMENT INVENTIONS - A NEW RESOURCE?
Mary A. Holman (George Washington University, Washington, D.C.).
Land Economics, vol. 41, Aug. 1965, p. 231-238. 18 refs.
Grant No. NsG-425.

Review of factual evidence which shows that patented inventions that arise from government-financed research are not a great economic resource. The number and nature of government research and development (R and D) inventions are discussed, and the term "commercial use" is defined. Information about the commercial use of inventions arising from government-financed R and D is given, and the commercial value of inventions is investigated. Nonuse of government patents is briefly considered, government use of inventions is appraised, and other outputs with possibilities of commercial exploitation are mentioned. B.B.

A65-23801
SPACE TECHNOLOGY - PAY-OFF FROM SPIN-OFF.
John G. Welles (Denver, University, Denver Research Institute, Industrial Economics Div., Denver, Colo.) and Robert H. Waterman, Jr. (McKinsey and Co., Inc., Geneva, Switzerland).
Harvard Business Review, vol. 42, July-Aug. 1964, p. 106-118.
NASA-sponsored research.

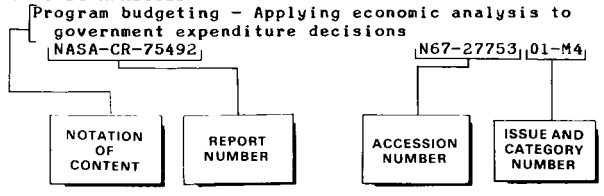
Survey of the type of derivative applications of space research and technology. Two types of spin-offs are discussed: tangible, which is the transfer to commercial use of well-defined products, processes, or materials originally developed for space-related applications; and intangible, which is the transfer of scientific and technological information to commercial use. The intangible spin-off is considered the more important by far. It is found that attempts on the part of management and government to increase the spin-off frequency have suffered from a fuzzy picture of the nature of spin-off. Especially important is found to be management's ability to: (1) bridge the gap between space-related technological knowledge and commercial market requirements, (2) identify individuals who can tap the formal and informal sources of spin-off ideas, and (3) provide an environment that motivates them to do so. It is concluded that in the last analysis, government can be helpful but the process requires private initiative. M.L.

A65-18730
GOVERNMENT POSITION ON QUALITY CONTROL WITH SMALL BUSINESS CONTRACTORS.
Ernest W. Brackett (NASA, Washington, D.C.).
IN: NATIONAL SYMPOSIUM ON RELIABILITY AND QUALITY CONTROL, 11TH, MIAMI BEACH, FLA., JANUARY 12-14, 1965, PROCEEDINGS. [A65-18710 09-15]
Symposium sponsored by the Institute of Electrical and Electronics Engineers, American Society for Quality Control, American Society of Mechanical Engineers, Institute of Environmental Sciences, and Society for Nondestructive Testing.
New York, Institute of Electrical and Electronics Engineers, 1965, p. 187-190.

Review of the part small business concerns can play in the national economy, regarding NASA and DOD contracts. It is stated that the government considers small businesses an important part of the economy. Many small businesses are found to be unfamiliar with government procurement, including subcontracting, and need the help of both the government and the prime contractor in securing contracts and performing their work. It is concluded that this is particularly true with reference to reliability and quality control problems. M.L.

Subject Index

Typical Subject Index Listing



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Program management study on effects of PERT on industries with large R and D organizations
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Extension of configuration management techniques to computer programming
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Configuration identification data and management procedures for Voyager project
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CONTRACT MANAGEMENT

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Government position on quality control with small business contractors A65-18730 01-M9

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Management model for selecting major subcontractors in aerospace industry
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Managerial methods of successful project managers not restricted by detailed customer procedural procurement requirements
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CONTRACT NEGOTIATION

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Comparative study of effectiveness in winning government research and development contracts
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Minimum average cost ordering policies for two product inventory systems with joint setup costs
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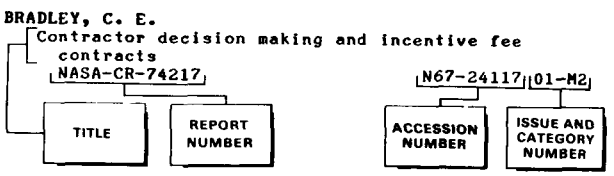
Typical Personal Author Index Listing



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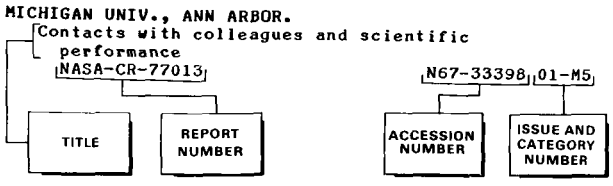

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AMERICAN ACADEMY OF ARTS AND SCIENCES, CAMBRIDGE, MASS.
Businessmen review the space effort /problems in review/
NASA-CR-51798 N63-23071 01-M9

AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, NEW YORK.
Motivation of technical personnel.
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B

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Development of a mathematical model of the human operator*s decision making functions Final report
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BELLCOMM, INC., WASHINGTON, D. C.
Procedures for management control of computer programming in Apollo
NASA-CR-80132 N67-12167 01-M1
Configuration management of computer programs
NASA-CR-88490 N67-36770 01-M4

BOEING CO., SEATTLE, WASH.
Voyager spacecraft system Task C configuration data and management study Final technical report, Apr. 1966 - Jul. 1967
NASA-CR-89735 N67-39766 01-M1

C

CALIFORNIA UNIV., BERKELEY.
Decision making and resource allocation in a Public Health agency Internal working paper no. 18
NASA-CR-60632 N65-81945 01-M1
Competition, efficiency, and military R and D contracts Internal working paper no. 26
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NASA-CR-85857 N67-30860 01-M5
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NASA-CR-85799 N67-31488 01-M9
Technology and urban management Semiannual report, 1 Oct. 1966 - 31 Mar. 1967
NASA-CR-86664 N67-32557 01-M6

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Functional ambiguity and the cushioning of organizational stress
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Managerial methods of successful project managers with a loose rein
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An entrepreneurial theory of formal organizations. Part I - Patterns of formal organizations
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Some determinants of organizational success
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Optimal continuous review policies for two product inventory systems with joint setup costs
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The PERT/COST system design N62-16057 01-M4

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The channels of technology acquisition in commercial firms, and the NASA dissemination program
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GENERAL ELECTRIC CO., SANTA BARBARA, CALIF.
Planning a least cost reliability constrained development program - A capacitated network approach
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Application of aerospace technologies to urban community problems
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Interaction of United States objectives in space with those on earth - Program of policy studies in science and technology paper no. 2
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Science in national policy - A preliminary inquiry Paper no. 1
NASA-CR-57428 N65-19894 01-M9
Science, technology, and the national posture note no. 1
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The management of science
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